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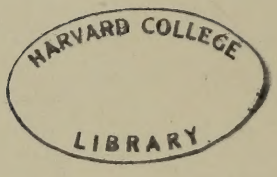
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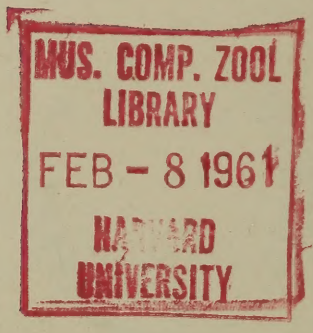
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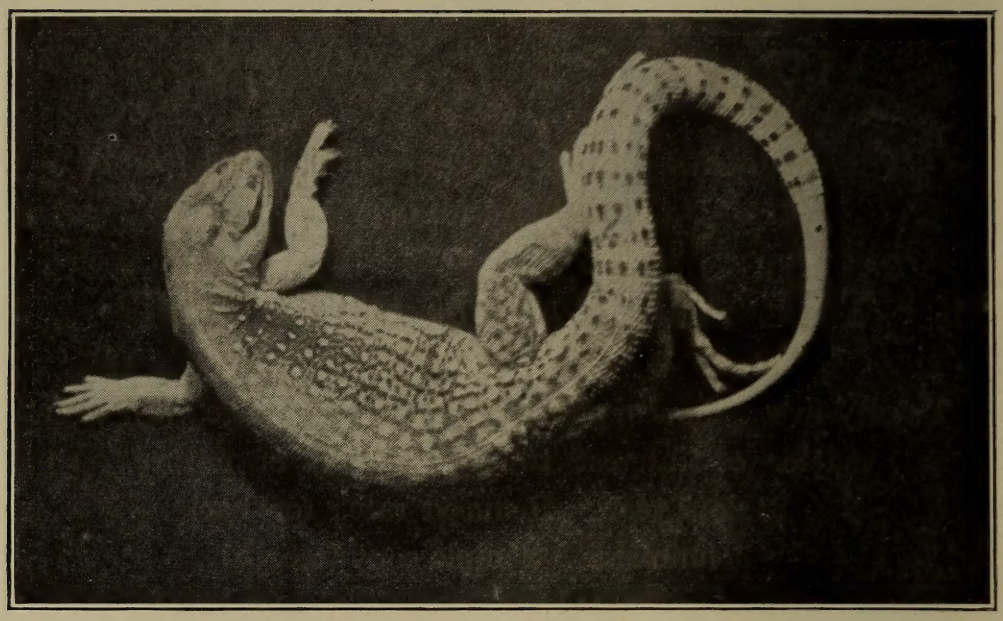

The desert iguana, one-third natural size. Note the tip of the tail which is being regenerated

TABLE OF CONTENTS

A Journey to the Salton Sea. P. Munz - - - - - 1
Impressions of Porto Rico. E. E. Barker - - - - 10
The Boy and a Brook. B. C. Reynolds - - - - - 13
A Night on Vesuvius. E. B. Whiting - - - - - 23
The Yew Berry. Poem. E. M. Provost - - - - 26
Just Ooze and Slime. E. L. Palmer - - - - - 27
Florida. Poem. W. P. Alexander - - - - - 32
Geography and the Menagerie. E. Hausman - - - - 33
Note on the Cabbage Butterfly. F. E. White - - - - 43
Editorial - - - - - - - - - 44
News Notes - - - - - - - - - 45
Book Shelf - - - - - - - - - 46

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A Journey to the Salton Sea

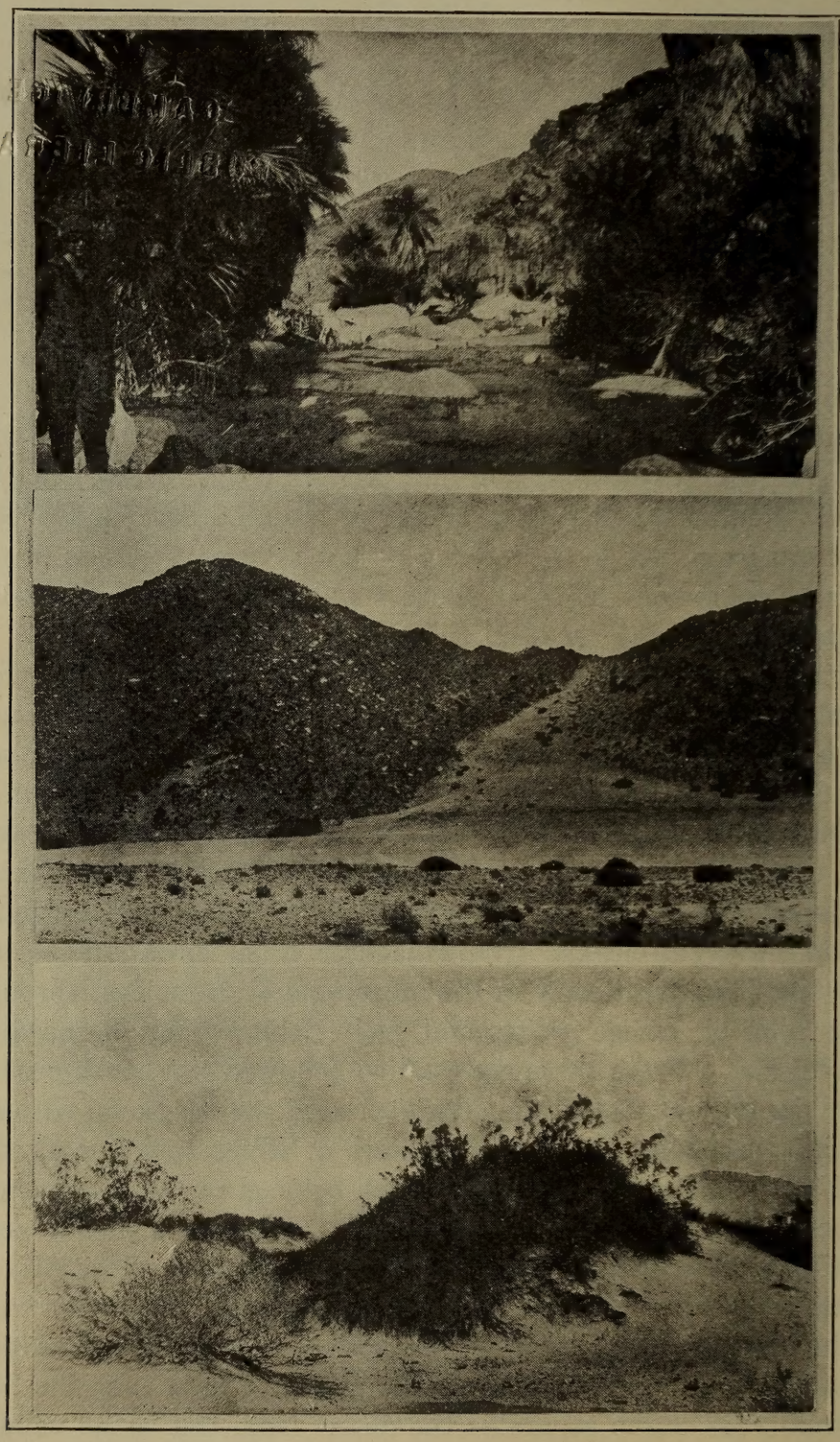
PHILIP A. MUNZ, Ph.D.
Professor of Botany, Pomona College, California.

If you will turn your atlas to a map of southern California, you will see in the extreme southern and eastern corner of Los Angeles County the town of Claremont. Here is situated Pomona College, and it was from here in March 1919, that several members of the Botany Department of the College started early on a Tuesday morning for a spring vacation on the Colorado Desert.

With plant presses on the front and side of the machine, with the other side built up to carry food and camping equipment, and with a huge roll of bedding under one of the plant presses, our little Ford, that trusty desert car, took on at once that air of indifference to appearances, which so many cars of the southwest have, especially those that are accustomed to travel on the desert, The desert with its dry scorching winds and its intense beating light, soon takes away all elegance from a machine subjected to its fierce sun.

We left Claremont early in the morning and drove east through thirty miles of orange groves and grain fields to San Bernardino for breakfast. From there the road we followed was south-east to Redlands, then we began the climb through the chaparral with its beautiful wild lilac, the flower clusters of which look for all the world like those of the lilac, but which belongs to the same genus as does the New Jersey tea, *Ceanothus*. We found also a very beautiful lousewort much resembling the *Pedicularis canadensis* of Eastern woods and fittingly called *P. densiflorus*. The road soon left the chaparral and led us to the apricot and apple orchards of Beaumont and Banning in Riverside county; then over the San Gorgonio Pass which separates the desert from the fertile valleys of the Pacific slope.

This pass has to the north of it, San Bernardino Mountain (11,600 feet), and to the south, San Jacinto Peak (10,987 feet); both peaks white with snow and visible from the desert below.



Palm Canyon

Desert mountains with a great cone of sand blown against them. Near Whitewater

A typical small sand dune about the base of a desert shrub. Near Whitewater

These two peaks give the names to their respective mountain ranges which run almost parallel in a general north-west and south-east direction, and shut in a vast desert valley, the Coachella, a place dry and hot, yet with water near enough the surface for irrigating purposes. The annual rainfall for points in this valley as well as in the Salton Sink and Imperial Valley to the southeast of it, is given as averaging about two and one-half inches. One does not need to own many umbrellas unless to ward off the rays of the sun.

After one crosses San Gorgonio Pass, he very soon goes into an entirely different life zone. The grassy slopes and blue larkspur, chia, and Phacelias give way to the joint-firs (*Ephedra*), creosote bush (*Covillea*), and yuccas of the desert. A ride of a few miles takes one to Whitewater, a region of blown sands which are heaped up by the wind as small dunes about the base of desert shrubs or are thrown in great masses against the gaunt, bare, rocky base of the mountains. Far above, these same mountains show stretches of bright green, darker slopes covered with conifers, and the white of snow-covered peaks.

Cruel as the desert sometimes appears, unkind and terrifying as it may be, it is at this season so mildly pleasant, so warm and soothing, so varied in hue with the pinks and blues and grays, that it is altogether an enticing place,—until the wind blows.

A journey of a few miles from Whitewater brings one to Palm Springs, a veritable oasis and most surprising place. Originally a little Indian settlement, it has, because of its mild dry air and unusual surroundings, become a favorite stopping place for the Eastern tourist who may be so fortunate as to be able to part with about $15 per day. From Palm Springs one can go to a number of canyons, in the lower parts of which grow native palms, the fan palms of California, which appear at the edge of the Colorado desert in a clay stratum that apparently catches the water coming down from the strata which lie above. These palms are very interesting and a trip to Palm Canyon is worth anyone's time. Here we collected a number of interesting things in the way way of plants: a composite which looked like a mallow, a wild tobacco, and some peculiar little ferns. Cactus is so abundant that in our first night's camping place, near the mouth of the canyon, we had to use the road as the only place free from the spines and had to bestir ourselves early the next morning to make

room for the first travellers. Our stay here however was a delightful one; and the night was made melodious with the songs of the tree toads in the little stream near by. Palm Canyon is also known for its hermit, a man who has lived the godly life (and sold postcards to the tourist) for a number of years. Rumor has it now that he is giving up his asceticism and returning to the Great White Way to make up for the years he has missed on the desert.

Wednesday morning we left peaceful Palm Canyon and started over the desert again through regions of mesquite dunes where the mesquite hung heavy with mistletoe, which was in full bloom and made sweet the air for long distances. Then we would traverse long dry stretches almost without vegetation, but with that wonderful blue haze always hovering about the horizon.

The monotony was enlivened by the occasional passing of a raven or of some other bird. Then too, when the day grew warm, one could always find a lizard; do let me say something about lizards. For real genuine sport, I know of nothing more exciting than to rush madly over the desert from one clump of bushes so another in pursuit of a lizard which consistently refuses to stand still long enough to be made a zoological specimen with the aid of a twenty-two rifle, and which finally ends the chase by disappearing into a convenient burrow.

The lizards about Palm Springs are of many kinds; one of the most striking is the gridiron-tailed lizard (*Callisauis ventralis*) a very long legged and swift fellow that holds aloft his tail with its transverse black bars on the under side, and scampers over the desert at the rate of at least one mile per minute. Then there is a vegetarian, the desert iguana, whose large chunky body reminds one of a prehistoric form, but whose speed is assured by its large feet. This lizard bears the euphonious name of *Dipsosauris dorsalis*. It is of a light color with reddish brown transverse bars on the body and long tail. Another striking one is the ocellated sand lazard (*Uma notata*) a swift runner with fringe on his feet and with beautifully marked body. The chuckawalla (*Sauromalus ater* is the largest one of all; I did not get to see it however, but there were other smaller ones like the whip-tailed lizard (*Cnemidophorus tigris tigris*), and brown-shouldered lizard (*Uta stansburiana elegans*). These with the rattlesnake that one always looks for and rarely finds, add largely to the interest in the desert.

The Wednesday journey led through the famous Coachella valley, the date region of California, to the fascinatingly interesting country beyond, that of the Colorado desert, the Salton Sink.

Those who have read the "Winning of Barbara Worth", have some idea of this tremendous region which lies below sea-level. There are everywhere evidences of its having once been filled with water; one can see old shore-levels about the edges, the now barren desert sands are full of shells of clams and small univalves which can be scooped up by the handful where the winds have concentrated them like common sand.

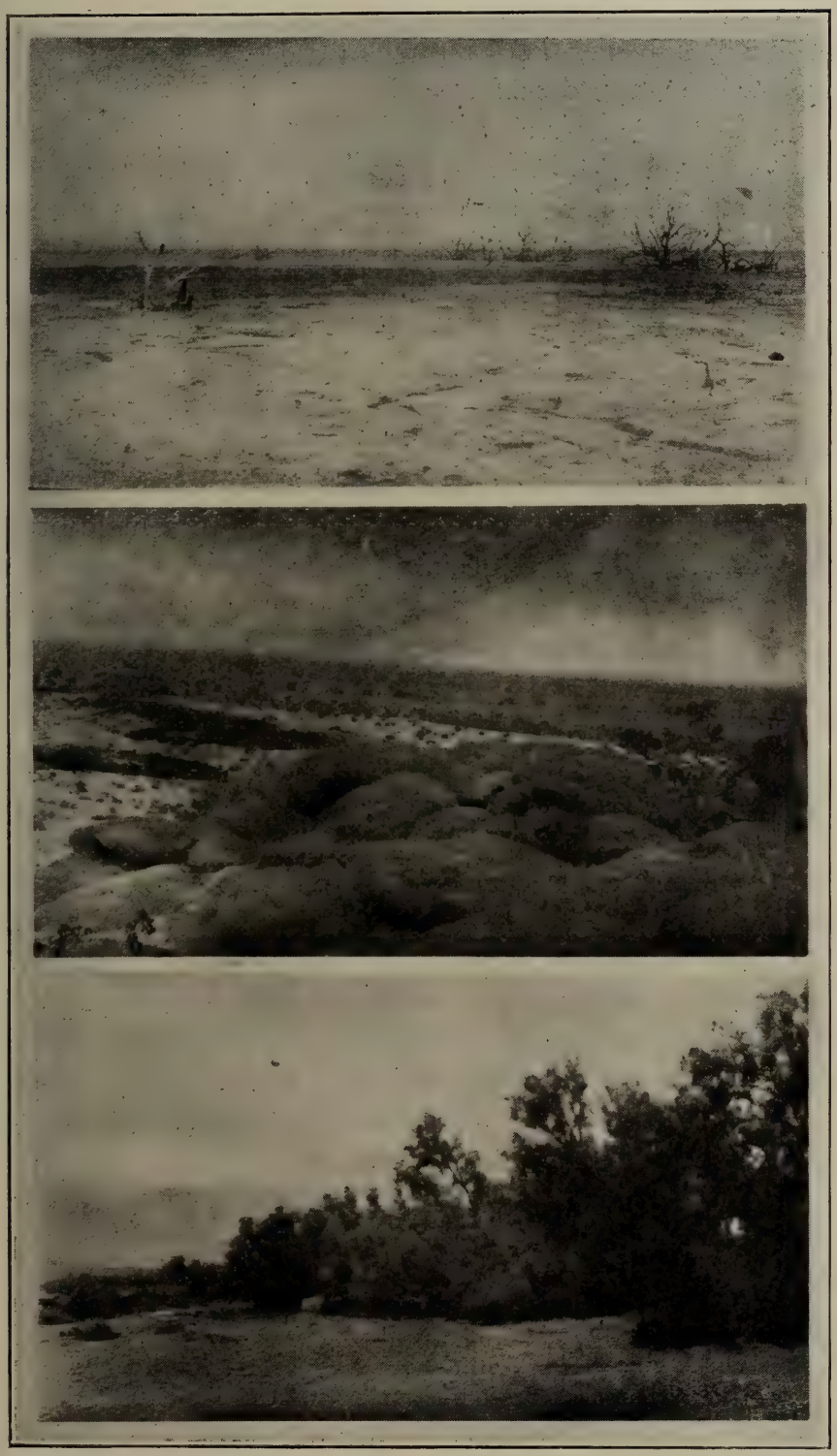
Geologists generally believe that the area of the Salton Sink was at one time an arm of the Gulf of California, that the Colorado River separated the two by its delta, that the waters of the river being diverted to the south, those in the Sink gradually evaporated and receded, occasionally perhaps being added to by the Colorado River in flood time as it washed new channels in its delta. But Mr. E. E. Free, apparently on good grounds, urges that the water to the north of the delta, Blake Sea, whatever its origin, was soon comparatively fresh; for the shells to be found are none of them marine, and some of the rocks near the old shore-level are coated with a thick tufa, a calcareous mass which cements rogether many of the rocks, and which is very evidently of fresh-water origin. At any rate it is evident that this basin was once filled with water and to see xerophytic desert shrubs growing among water deposits and shells, is, to say the least, interesting.

The Sink is an area eighty miles long and with a maximum width of thirty miles. The Southern Pacific Railroad crosses it near its northern limit and apparently was far from any water when built. During the season of 1891 the water from the Colorado River many miles to the south, having filled many of the small channels and lagoons to the south-west flowed through into Salton Sink and formed a lake several miles long. The intervening region was little known and the appearance of this body of water so near the railroad caused all sorts of rumors until one or two venturesome individuals made the journey by boat from the river to the lake and solved the mystery. It is said that old settlers are of the opinion that some water came into the Salton in 1840, 1842, 1852, 1859, 1862, 1867 and almost every year since 1890.

In 1900, the various channels forming this natural waterway, were begun to be cleared and connected and by 1901 water was being used for irrigation purposes in the southern part of the valley now called the Imperial Valley. Having unsuitable headworks, as more and more water was required, other channels were cut and in 1904–05 a tremendous flood in the river began to cut and enlarge the channel so that by the end of 1905, almost all of the river was flowing into the Salton Basin. It was not until 1907 that the engineers were able to turn the river into its proper channel, which had become so choked with plant growth and silt that the river made repeated attempts to escape. It is estimated that it displaced and redistributed in the Sink over 450,000,000 cubic yards of earth, "almost twice that of the Panama Canal." The deep gorge-like channels of the New River and Alamo show how much material was carried; in truth, one of the chief causes for alarm for the engineers was that these tremendous cuts would work back to the Colorado itself and the whole valley would be lost to man. Even though an early control was effected, it was done only after an inland sea forty-five miles long and seventeen broad had been formed, with a total area of 410 square miles and a maximum depth of eighty-three feet. It necessitated the removal of the Southern Pacific track for sixty-seven miles to a higher and more northern bed.

After matters were again under control, the Salton Sea, as it was now termed, began to lose its water, as it had no doubt done many times before, by the evaporation of tremendous quantities into the intensely hot dry desert air. It has now gone down so far that in places its shore-line is a mile or more below that of some years ago. But the waters did their work and killed the mesquite and other desert shrubs and low trees, leaving on them a white incrustation so that their white exposed skeletons stand out clearly and will no doubt remain for many years, so slowly does decay proceed in the desert.

As the water has receded, it has left a white deposit on the soil in which only few plants can grow, such as the fleshy *Spirostachys* (a close relative of *Salicornia*), and *Sesuvium*, a member of the Portulacaceae. Judging from the huge scales left on the exposed shore, the water of the lake has produced tremendous carp which washed in from the Colorado River at the time of its overflow. The beach is also covered with great masses of dry



The Salton Sea. Dead shrubs dating from the time of the overflow, add to the desolation

Near Sea Level in the Salton Sink. The rocks are cemented together by a deposition of tufa

A wash near the Salton Sea. The trees (Parosela spinosa) are without leaves and covered with spines

Ruppia which bleach and turn white in the desert sun, or are covered with a salty deposit.

One does not see much animal life about the lake, except for the large number of ducks and a few other birds.

Mammals are not very abundant in the vicinity, an occasional rabbit is seen; but the greatest stir among the mammals occurs at night. Then the desert is thickly populated with those delightful little creatures, the kangaroo rats, a misnomer, since they are not rats and in no way suggest anything so repulsive. They are cunning little brown fellows with the large round eyes characteristic of nocturnal animals, and with large well developed hind legs for jumping and much smaller weaker front ones. The tail is very long, is used for balancing, and has quite a little brush toward the end. The Small Mammal number of the National Geographic (1918) has a very good plate and description of these amusing little fellows. They hop about over the desert with great agility and speed and are not much disconcerted by a flashlight, but go on about their business of food-hunting. The last night of our stay on the desert between Indio and Palm Springs, my ground-cloth had on it quite a pile of peanuts which I had placed there to enjoy after going to bed, but some of which I had not eaten after all. Just before dawn I awakened and had the satisfaction of watching them disappear one by one into a neighboring clump of bushes where a kangaroo rat had his burrow. He would come out, hop straight to the pile of peanuts near my head, using his large hind legs and tail largely as a kangaroo does, then getting a peanut in his mouth, would convey it to a place of safe-keeping. I scattered the pile so that some lay directly in front of my face. Each time he had to come nearer to me and finally, his tail almost brushed my face as I lay watching my last peanut disappear. When eating, the kangaroo rat has the same erect position that a squirrel takes, using his front feet as hands.

I cannot blame the desert mammals for being nocturnal; the spell of the desert is never so strong as at night; the vast stillness the extreme clearness, the tremendousness that it makes one feel are very restful and soothing. The occasional distant howl of the coyote or call of an owl gives just the right touch to make complete the spirit of mystery that hovers over all. Then in the morning when the east turns red, and the sun comes up a great fiery ball, the distant mountains and hills come forth from the

shadows of the night only to enfold themselves in that blue haze that always invites one on and on, and makes charming the most forbidding aspect. Such is the desert at its best.

But to return to our excursion. On Wednesday night we camped about a mile from the shore of the Salton Sea at Figtree John's Spring, a little oasis indeed, with good cold water flowing from a sedge-filled basin, but it does not flow far. From here we walked to the Sea and also in the opposite direction, to the ancient shore-line where after some little climbing we reached sea-level.

We had wonderful meals on the desert; I remember the supper at this camp; fruit cocktail from tin cups, bread, butter and jam, and a stew containing everything available from canned beef, corn, tomatoes, onions, potatoes and water to salt and pepper.

The next noon we turned again toward Mecca, as all the faithful ought, but passed it by and went directly to Indio. A sandstorm was raging; the air was white with it and we sought the most sheltered spot we could find back of some rocks, made our fire and prepared to camp. After our supper of hamburger steak and boiled potatoes, we felt it would be more comfortable to ride than to try to stay in the blowing sand, and set forth again. In a comparatively few minutes, we were again in a land of calm and found a very comfortable place to sleep. Thus quickly can one pass from wind to quiet; the air-currents are apparently largely controlled by the mountain ranges and a distance of a few miles makes a great difference. Even when the wind is not blowing, the heaping sands about the mesquite and other shrubs show the customary path of the air-currents. Two or three milestfurther on, these dunes may be lacking entirely and one finds great stretches of scattered creosote bush interspersed with smaller forms of vegetation.

Thursday morning we were not near any stream or spring, and as there had been almost no rain this season, we did not need to spend much time collecting. We therefore effected an early start, a very fortunate occurrence; for in the afternoon a combination of four blow-outs and a worn-out pump delayed our arrival in Claremont until late in the evening.*

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*For an account of the Salton Sea at once scientific and interesting I would refer any one to the publication of the Carnegie Institution written by D. T. MacDougal and collaborators and issued in 1914.

Impressions of a Nature-Lover in Porto Rico

E. Eugene Barker
Insular Experiment Station, Rio Piedras, Porto Rico.

The writer once heard of a party of tourists whose sole interest in travelling seemed to be in arriving at a hotel where they could try new dishes. The nature-lover need not be a gourmet to enjoy tasting new dishes, for the satisfaction of his gustatory taste will be secondary to his interest in the novel foodstuffs themselves. But his chief delight as a traveller, wherever he goes, is in finding old animal or plant friends or meeting their relatives, and in making entirely new acquaintances. His pleasure, then, will be in proportion to his past acquaintance, to his temperamental capacity and his opportunities.

Now, a stranger coming to Porto Rico for the first time will be overjoyed in many instances but disappointed in others. Nature lavished her gifts abundantly upon this island, but remember man has lived on it for over four centuries, and as elsewhere, his presence has made many alterations. A friend of mine, coming here, anticipated that he could explore tropical jungles. He was disappointed when he found the Island to be as thickly populated as any of our New England States,—somewhat over 300 persons to the square mile,—and the forests had been almost entirely destroyed. Only a very little timber remains and that is preserved in a government reserve in the highest mountains. The watersheds have been denuded and fuel is very scarce. Wood is all burned in the form of charcoal and the average of less than a half cord is the amount consumed per person a year. The heavy rainfall quickly runs off from the steep surfaces gorging the stream channels for a few hours, and were it not that the soil is a very tenacious clay, it seems the hills would long since have been reduced to level plains. Here, surely, is an object lesson and a warning to Americans to practice forest conservation at home before it is too late to save our forests.

With the passing of the forest shelters and the increase of the population, doubtless, the wild life has greatly decreased. There are no large mammals and the mongoose, an introduced animal, is said to be responsible for the small numbers of smaller mammals, ground birds and reptiles. The native crow, unlike our own, fails to hold his own against civilization and settlement, and he exists

today only in small numbers in the dense, humid forests of the Loquillo Mountain Reserve. Snakes are almost as scarce as in Erin, though some exist. A friend from the mountain districts tells me that he has seen a large snake descend from a tree. Instead of climbing down or jumping, it coiled itself into a spring and dropped from the bough. Lizards there are, everywhere, abundant in numbers and species,—active, tame little creatures which cock their bright eyes at one with a trusting, birdlike expression.

One of the first and lasting pleasures of a nature-lover is the song of little Kokee, a small frog who lives in the meadows and low trees, and whose voice has given him his name. All day long he sings from the deep grass but as the shades of evening fall, all his friends join him until the night air rings with the tinkle of their jingling bells, for all the world like a May night up North.

Birds seem to be scarce,—honey-creepers, kingbirds and blackbirds being most in abundance. Many of the northern warblers, the palm, myrtle, black-and-white, water thrushes, redstart and many others are said to visit the Island in winter. The redstart is here called "candelita," which means a little fire. The most abundant bird of all is "reinita," the honey-creeper of bananaquit. She is everywhere and often flies into houses, where she helps herself to sugar or anything sweet that she can poke her sharp curved beak into. Her colors are green and yellow and bluish gray and her size and voice are similar to the wood-warblers. There are two species of owl,—the short-eared owl, a rare species, of which the writer has had the good fortune recently to see a young specimen, and the somwehat smaller bare-legged owl called "muscaro." He is similar to our screech-owl in size and appearance and his thin, wierd trill on a moonlight night is truly screech-owlish. He often frequents the coffee plantations and because the mangled remains of the juicy red coffee berries are found on the ground in the morning the damage is laid to him. Doubtless the real culprit is the rat, as neither stomach contents from many specimens examined, nor experiments with caged birds have afforded any incriminating evidence against him. It is another instance where the wisdom of the Arab's proverb is seen—"To avoid suspicion, do not stoop to tie your shoelaces while passing through your neighbors melon-patch."

One is delighted with the princely palms, of which there are several, and which are put to various uses. They add immeasurably to the landscapes. Up in the hills the tree-ferns rear their wonderful crowns above the shrubbery foliage of more prosaic and lowlier vegetation and it cannot fail to thrill a nature lover to see them growing here right out-of-doors and uncared for. Oranges grow wild in these districts and are excellent. Indeed, the bulk of all oranges eaten here or shipped away are from wild seedling trees. There are many kinds of bananas and plantains, which form a large part of the diet of the native population, and are eaten raw or cooked in various ways. Other fruits there are, novel in looks and flavor, and strange kinds of vegetables. One kind of breadfruit has fruits filled with fruits called "chestnuts" which are boiled and eaten,—they do look like real chestnuts, although they are as large as the Italian varieties and what is more, they taste like chestnuts.

Amidst all the wealth of vegetation and tropical luxuriance, however, one finally comes to miss flowers. True, there are some very conspicuous ones, but there is no abundance as in the Northern States, where the shorter growing-season spurs the plants on to bloom quickly and profusely. Here, nature seems never to paint the landscape with sweeping strokes of color. There are no such sights as roadsides gloried with dandelions, banks lit with autumn asters and flaring goldenrod, or fields where goldenrod or buttercups spread the cloth-of-gold. Daisies and clover are unknown here.

Everything is so different to what one has known in the temperate North that one is apt to overlook the likenesses which underlie both zones in life conditions and habits. How do the birds know when to mate and nest?—Yet they do so regularly. When are leaves to be shed?—Yet some trees are regularly deciduous and remain bare during a part of the year. When can plants flower and produce seed with best chances of survival? They do, each in its own time. And when should men sow or plant their crops? For them, too, there are special times best for planting, growth and harvest. Old Mother Nature is the same at heart, the world over, and she treats and trains her children the same, wherever, whoever they be.

A Boy and a Brook

BERNICE C. REYNOLDS
Buffalo, N. Y.

Dear Mother:

Do you know what a brook is? I always thought it was just a little water running along in a crack in the ground and not any where near big enough to swim in. But it isn't that. Why, the brook makes the crack and I thought the crack was always there. Sis said it wasn't worked out that way and that there were lots of things a brook could tell if you only kept your eyes wide open. That seemed awfully queer to me so while I was down in the meadow yesterday morning looking for new woodchuck holes, I took a good look at the brook there. I didn't see much, only a lot of stones and a little water, lots of grass, green stuff and *no new* woodchuck holes.

I didn't think much about it until after dinner when I was wishing the Simpson boys would come home again so's I could have a good game; just the afternoon for one. Then I got to wondering why the meadow brook made such a *crooked* crack when my geometry book says it would be less trouble to make it in a straight line. I couldn't figure out so I asked Sis all about it. She asked me to take her down to the meadow and perhaps she could explain some of the things to me. I said I'd just as lief go, there being nothing better to do.

The brook starts from a small spring 'way up in the woods above the meadow so we didn't go that far. We started where the brook just trickles under the upper fence towards the south side of the meadow. Right under the fence it had made a little pocket and the water hardly ran at all. It was very still and clear so you could see all the sticks and stones on the bottom.

Suddenly we heard something rustling and shaking itself in the wild cherry tree, beside the fence. Everything was so quiet that we couldn't help but hear it. We looked through the leaves, and just over the pool we saw a song sparrow (yes, I did know it was a song sparrow) shaking himself. He's just had a bath, Sis said, right in that water pool. So a brook *is* big enough after all, for some things to bathe in and have a good time. From the pool, on down the field for a way the water just trickled and hardly found its way through the grass so I got to looking more at the grass

Photo by Verne Morton

The tile under the road was so large that Sis thought that there might be a phoebe's nest in it

I noticed that it was very tall, thick and spindling and Sis said grass always grows that way where the ground was soft and water was handy. I smelled something like peppermint candy along here and asked Sis. Sure enough, we found the very plant they get peppermint from and right along side of it 'most as thick as the grass was another kind of mint'. Even wild mustard plants like to grow in soft ground because there was a lot of it.

Before we went very far we came to two more pockets and Sis told me to notice the sudden drop at the beginning of each pocket. Then she told me how the pockets were made. You see the water rushes along and washes the stones off clean. It is going so fast that it has power enough to carry all the tiny pieces of earth and stones along with it. Then the force of the falling water over a large piece of rock wears out a pocket from the soft ground. The water can't run along so quickly here so it finds its load of dirt too heavy and it dumps it all on the bottom of the pool pocket and leaves the water clear. This layer of dirt is called by a funny name "silt."

There were queer marks all over the silt so Sis asked me to look out for the cause. Soon I saw some snails ploking along the bottom. Then I noticed some little sticks really crawling and marking up the bottom. Sister took one out and showed me how a little worm was tucked away inside. They are called "Caddisworms". They build themselves little tubes of sticks and moss to live in until they are grown up and ready to come from the water. Their houses are fastened to them, and they carry them wherever they go. Just then a great long-legged bug started to walk along on top of the water. Sis called it a "water-strider" and showed me how its feet were made so that it didn't press too hard on the water and could walk right along.

The brook flowed on from the last pocket very swiftly. Some of the stones at the edge of the brook were moist and must have made a good place for moss to live for there were at least three different kinds on each stone. Sister showed me how weather-beaten (isn't that a funny name?) and worn out the moss made the rocks. We heard a bubbling laugh over in the field beyond, with a plain-enough "Spic spank spink." Sis said they were bobolinks and liked to live down in the grass.

May 29, 1919.

Dear Mother:

I didn't finish telling you everything because I got tired of writing. This will be the longest letter I have ever written but I've just GOT to tell you all about the brook if it takes me 'most a month. I didn't 'spect boys cared about such things but its great fun when you know how to look around.

We found out before we went home the first day that the brook had another arm over to the north and that this arm was doing a lot more work than the southern one. So we traced it back to the upper fence where it began very much like its brother. Only here is was steeper so it ran much faster and had dug out quite a bed for itself. There were more rapids and more stones washed bare. Sis showed me where the banks were of soft earth and were saved from being washed away by the masses of tangled grass-roots which made the bed more solid.

We sat down near this part of the brook for a while to listen to the afternoon converstation of the brook and of the birds, as Sister called it. And I guess the brook really does talk, Mother! You ought to hear it laugh when it tackles a good sized stone and you ought to hear it sort of whispering to the grass as it scoots under it. Then we heard some twittering noises and there were some gold finches and a song sparrow in one of the trees. There were more bobolinks laughing to each other over in the field and 'way off we heard a faint whistle of, what Sis called a meadow-lark. She is going to show me the picture of all these birds and of a lot of other birds too, when her bird book comes.

The brook looks as though it would be something after the two arms met although it does wander around through a swamp. There are a lot of old, dead cat-tails around where it is very soft and muddy water-cress and new weeds have grown up. The bank slopes gradually while the bank is steep because the earth is softer on the side and there are not so many rocks to stop the work of the water. Both of the banks along here must be rather old because there were big great pine trees which sister said were at least two hundred years old. We guessed at measuring a chest-nut tree and thought it was about 60 feet high. By stretching my arms around the trunk and pacing around it I guessed it was 14 feet around it.

One of the pine trees had two tops and sister told me how it happened because I noticed that pine trees generally have only one top. You see, 150 years ago, when this tree was young a hungry insect that liked the tip twig to eat and thought it would be a good place for its eggs, so the young tree had to lift up two branches to take its place. That's interesting—wish I could see the insect who did it.

While we were looking at the tree we heard an awful squawking and what do you think happened? A red-winged black-bird with his red shoulder straps standing up on end was bothering a Mrs. Robin on her nest in the tree. Soon Mr. Robin came along. Then there was more squawking and Mr. Red-wing had to leave double quick. We left Mr. Robin to grumble away on a fence-post and went on down the meadow. There were a lot of trees I didn't know about at all. Some of thier names were pretty and some were only queer. You will see them on a map I am going to make soon of the whole brook.

There were a lot of things in the way of the brook. My, but it had to work hard and run fast here. In one place the ground was so hard that the water had to make a wide curve like a half-moon. We named the piece of land Half-Moon Cape. Further along some dead willow trees were stopping up the brook and laid right across it. Sis said their roots looked as though the brook had helped to wash them out when it had its extra supply of spring rain water. We had a good look at a red-headed woodpecker across the brook in a patch of wood just beyond the fence. His head was very red and he was so black and white you could have seen him 'most anywhere. We also heard the liveliest chirping sound—just like "witchity—wichity—wichity" and over in the thick bushes was a little yellow bird with black cheeks. You'll always find him in thick bushes He's a Maryland Yellowthroat.

Our brook disappears under the fence here and flows into a great pipe under the golf-links. It must come out somewhere so we are going to try to find it again on the day that brightest and hottest because if it's bright all of the brook's friends will be out for inspection. Gee, this is almost better than six ball games! I'm going to see where Mr. Brook ends up if I have to walk a week—guess it won't take that long.

June 1, 1919.

Dear Mother:

Yesterday was awfully hot and sunny so I kind of expected Sis would suggest brook again and sure enough she did. She asked me to meet her in front of Professor Brown's home out on Trip-hammer Road and I wondered what she could want way out there.

Well, what do you guess, mother? Our brook comes out of the long pipe down in the meadow beside Mr. Brown's house! And it comes out so fast that it had worn a great hole so we found large pools here. There were whole crowds of water-striders looking as though they were snow-shoeing to see who could go the fastest. A meadow frog, all green and gold, jumped along the edge with a splash that made us jump. We nearly missed seeing a crayfish because it was mud-colored and crawled along among the muddy stones. What queer looking animals they are, all legs and not much else. I poked him and he flapped his tail under and shot backward like a streak of nothing. We turned over some of the stones and found queer flat-looking bugs with long hairs for tails and small legs. They were sticking close to the stones. They're called stone-fly larvae. Larvae is a queer name for young, meaning baby stone-flies, I guess. There were a lot of mush-rooms around the upper edge of the brook that looked like sponges and are good to cook and eat so sister picked them.

The old goldenrod plants are mixed in with the new all over the marsh and I noticed a lot of round holes on their stems. I showed one to Sis. She opened it and there was a fat worm curled up asleep in its round nest. It was a larvae, no, *larva*, for a singular number, sleeping and growing up. On one side of the ball there was a tiny hole with bevelled edges so that the plug in it could be pushed out easily when the larva was grown up into a moth.

Pretty soon the brook became wider and had to run down a pretty steep grade. Its bottom was filled with stones covered with green, slippery stuff called "algae." We noticed holes or pockets in the edges and managed to poke out some little black water-beetles that were hiding . If I ever get my map done you'll see that there are a lot of small trees and bushes along here,—small, young elms, tiny, Scotch pines, raspberry bushes and lots of choke cherry trees in blossom. There was one poplar tree called a cotton-wood. It had feathery, sticky flowers or catkins that flew all over everything so no one wants this kind for their front lawn. By

this time we could see where the big slate rocks had come to the surface and were washed clean by the running water. The brook was *still* wider here. Its banks were made of worn off layers of slate. I couldn't understand this so Sis explained. How damp weather and then freezing of the water in the cracks make things swell up and these things crack up into pieces. Slate cracks off in flat sheets and every time a sheet of rock was taken off a little falls was made and there were a lot of falls along here. On the rocky banks there was just enough moist earth to grow a lot of ferns, violets and moss. It must have taken Mr. Brook a long time to wear away the rock because we saw a great many old trees, especially one great white oak almost tipping off the bank. That made it just shady enough for the ferns and violets. This was a first rate hiding place for the birds and we saw two warblers, a Blackpoll with a black cap and Mr. Maryland Yellowthroat with his black cheeks.

The water current must be strong here especially in the spring because there were sticks, mud and fine stones piled up at every turn of the brook. We had to skip stones in order to get along between the steep banks. It was fun and Sis didn't tumble in even once like girls usually do. We didn't have any more time, though, to see what happened to the brook because we were so slow and looked at so many things. We were up to where Mr. Brook takes a jump down through another pipe under Highland Avenue. I'm wondering how deep the brook has burrowed on the other side of the street.

June 7, 1919.

Dear Mother:

Its summer sure enough now because freckles and mosquitoes are coming out thick and fast. Dad called me "spotted adder" when he saw me last week but I don't care; girls only care. We finished up the brook yersterday and the mosquitoes finished us. I went bare-foot so's I could wade and wish I hadn't. Sis took me 'way out in front of Prof. Mason's house this time and we started there. You wouldn't know it was our brook at all for its most sixty-five feet arcoss and about forty feet deep. We paced it to get the width. The tile under the road was so large that Sis thought there might be a Phoebe-bird's nest in it so I crawled in but didn't find anything but water and mosquitoes. Phoebes build funny nests plastered up against stone walls under bridges and such places.

I never saw such steep banks for such a little brook. There were birch, red oak and shag-bark hickory trees along here, just about holding on to the rocks. Farther up were a lot of bass-wood trees and we could tell the mountain maple trees from any other maples by their long, pointed leaves. Pretty soon the banks became more sloping and were covered with a lot of slate-stone, dirt and dead leaves because the brook had found the rock too hard to work away very quickly. So here there was room for a lot of trees and old ones, too. It looked like a regular patch of woods. The pine and hemlock trees were tall. Away up in their tops we saw some yellow and gray warbler birds. Warblers stay in tall trees a lot and these like evergreen trees. We heard a bully song here, a real clear whistle. Wish I could whistle like that. It was a wood-thrush and it was so brown you would hardly see it. It had dark, wedge-shaped spots underneath. Sis says all the shy birds live here. There's one called the Louisiana water thrush that sang so much that Sis thought he must have a nest in the gorge. He's brown, too, and he shot up the gorge so fast I couldn't see him so Sis' bird-book for mine tonight.

We had to cross Stewart Avenue, finally, and we walked along the edge of the gorge on down hill, its even deeper below Stewart Avenue and there are a lot of small falls and rapids. We had to go through the backyard of Greystone House and the folks had a statute of a fat boy at the edge of the gorge. He was sitting and looking at a bunch of pink daisies and Sis started to rave about how cute it was. I couldn't see it and was glad when she let up and showed me a deserted warbler's nest at the end of a low branch of one of the trees near by. It was like a very small, round cup covered with moss and lichens. Near the flowers we spied a moth that looked like a bumble-bee but he was only a faker flying around in the sun.

Pretty soon there wasn't any gorge at all and when we reached a mud road down in the woods there was just the brook flowing under the bridge. When we crossed the road we had the surprise of our lives. The brook had turned into a narrow falls with more than an eighty foot drop I guess. And part of the falls was stopped up with a cement wall to make a pond at the top. We saw a lot of queer-looking ducks in another pond below us so we hurried down the path to it. Sis seemed to know who lived there and she was excited about the ducks. Do you know there's a man down

there that likes birds and knows them, too? He has the pond for ducks and lots of bird houses stuck up in the trees and on the fence-posts.

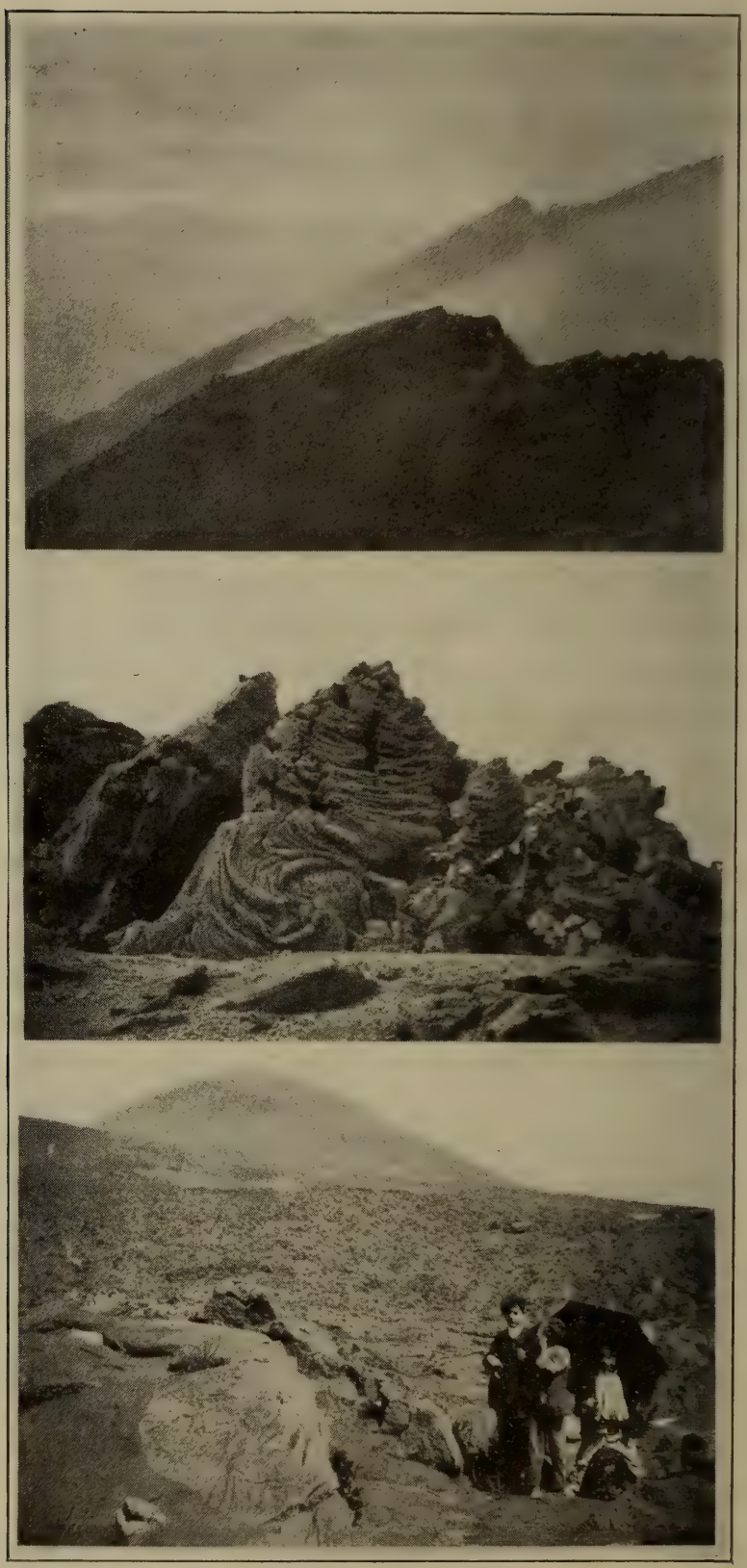
The ducks were wild once and they live in the pond now. The man cut off their longest wing feathers so they couldn't fly away to some other place. The pin-tail and canvas-back ducks weren't very pretty. I know them from father's game book. The blue winged teal and the mallard ducks had a lot of colors on them. Mrs. Mallard duck was swimming around with a lot of fuzzy, homely little ducks. They were only two days old and yet they could swim better than their mother. Sis says that some birds, 'specially water birds, can take care of themselves as soon as they hatch out. There was one great snow goose that tried to show us how well he could swim. Then we went to see some new partridge chicks in the chicken-yard. A Bantam hen was taking good care of them. They were smaller than ordinary chickens and looked like yellow velvet with brown strips down their backs. They ran around through the grass and Sis said they didn't crouch down like they do when they are wild and with their wild mother.

It was hot so Sis didn't want to go any further so she told me that if I wanted to see where the brook ended I could climb down the bank below the house and see what was happening. So I left her at the house and went down. I thought the brook would run into the lake inlet but it falls down the bank and goes down a hole in the ground and not a drop can you see after that. I hustled up to tell Sis and she laughed so I guess she knew all the time.

We've named the brook Vanishing Brook. I'm tired of writing so much; its awfully hard to write in such hot weather like this but I got so excited I had to let steam off somewhere, so I told you all about it. When *I grow up* I mean to know just as much as the bird man does about brooks and birds and everything thats alive. Wait and see.

Your loving son,

DAVID WELLS.



Looking East from the north edge of the Crater of Vesuvius

Twisted frozen lava folds—taken by a string to the camera.

I lined them up for a picture with the ash cone of Vesuvius in the background

A Night on the Summit of Mt. Vesuvius

Edwin B. Whiting
Branford, Conn.

To climb Mt. Vesuvius without a guide and to spend the night as near the rim of the ash cone as would be consistent with not rolling down the steep slopes, one must break the universal custom of tourists and, incidentally, the law of Italy. Whether all Americans find aesthetic pleasure in the breaking, as well as the making of laws, may be a debatable subject, but I trust my avoidance of the law which insists on the added burden of a guide on the climb to the crater edge of the volcano, will inspire a secret respect in the heart of the average American.

The upper part of the mountain is more barren than the Sahara, yet subject to frequent and heavy thunderstorms. A trusty umbrella and light waterproof cape were my provision against the possibility of too much sky water on the outer man; while the lightest form of canteen, a large rubber hot water bottle, carried a hopefully fever free supply of water for the inner man. From Naples, the tram carried me around the curve of the bay and deposited me at the base of the mountain. There the fun began.

My canteen called loudly for 'aqua buona.' A pocket full of the Italian language, I had in the form of a conversation dictionary, but my head contained only a few scattered words that slipped around and became dismally mixed in the general vacuum. At last, after the rapidly gathering multitude had wasted a shocking amount of language, and my rubber canteen had swelled with pride and water, I set off up the steep slope with the inevitable stone walls on either hand.

As foam flies from a wave, there came from the multitude an escort of five boys of varying degrees of smallness. To my dying day I shall never forget the unabashed cheerfulness of that escort. "De me 'un solde! came incessantly from each little imp, as they followed my toiling footsteps up the steep mountain side. 'Piccolo', the smallest and most importunate, received many a love tap from his fellows on his round close cropped head. Poor little barefoot dark eyed Piccolo! He was learning the pangs of the power of organized competition, and the only watered stock allowed him by the all absorbing trust took the form of tears.

Two thousand five hundred feet up the mountain they followed, till all signs of vegetation ended in rough tumbled lava.

As one ascends, the horizon appears to tip up more and more, while the glistening curve of the white houses of Naples defining the exquisite blue of the bay, seems gradually to sink away beneath one's feet. At the beginning of the rough lava fields, I ate my lunch like a bandit chief surrounded by a circle of fond admirers. They watched every move, those five small boys of Italy. With Piccolo, as ever, suffering competition from the trust, they ate every scrap of food donated, including some cheese rinds and vile butter. Lunch finished and the view admired as much as the distractions would allow, I started off over the tumbled, jagged lava, aiming for the base of the ash cone on the north side. My barefoot escort soon showed signs of distress. I lined them up for a picture with the ash cone of the volcano for a background; gave to each the long sought 'una solde,' and started again at a tremenduous pace over the pathless lava.

I dared not look back lest such a manifestation of interest should arouse the little beggars to further efforts. I must have gone half a mile, when behind me there arose a plantive wail.

Looking back, I beheld Piccolo alone, coming painfully after me, footing gingerly over the cruel lava. I waited for him, not so much from compassion, as from a need of a final renewal of my water supply. When he arrived, panting footsore, I flashed a copper and asked in my best Italian, "Where can I get water fit to drink?" He motioned me to follow and led me a short distance to the left of my route to a sort of oasis in the desert where nestled a single vineclad white house, the last place where a prospective law breaking brigand such as I, could get a drink of water. Piccolo ran into the house. Out swarmed the inhabitants. They admired and filled my canteen, receiving 'una solde' each, not forgetting Piccolo. I did not lose him here, however. He evidently looked upon me as a permanent source of income. Together we plodded on, ever upward, till, at length, we approached a gaunt frame building set with no apparent purpose in the midst of the black lava. As we drew nearer, Piccolo set up an infernal howl which caused the house to belch forth a choice collection of men and dogs. The dogs were incidental, the men were guides. In spite of the broiling sun, I sped out over the bleak lava. They followed for a short distance rather half heartedly, but their natural indol-

ence and the obvious lack of remuneration involved, soon led them to desist from the chase. Thus were the laws of man avoided, but the laws of nature were still in operation as I was soon to learn.

A hot and hurried two mile scramble over the endless lava slopes carried me from the house of the guides to the north side of the ash cone. The sun set a dull red ball. With the coming of darkness making further progress not only difficult, but dangerous, there began to grow a sense of nearness to a real live volcano. Here at the base of the cone, I spent the night, three thousand feet above the Bay of Naples and some six hundred feet below the actual summit of the mountain.

The stars were soon shining overhead, and dare I say also under foot? Yet so it seemed. The lights of Naples ten miles away to the northwest appeared like the vast constellation of the Pleiades drawn near. Other towns off to the northeast glimmered in the darkness as if they were other smaller star clusters at my feet. I felt as though in a void of outer space, floating among the stars. My pleasure, though exquisite, was evanescent.

Like the proverbial will o' the wisp, the lights began to fade and the stars one by one to shut their sleepy eyes, as the evening haze grew to a mist, the mist to a rain, and the rain to a storm. Long before midnight, torrents of water drove me from the sheltering gully where I had taken refuge from the wind. On a little ridge, exposed to the full blast of the storm, with a restive umbrella as a tent, I spent the remainder of the night. The thunder roared, the volcano rumbled, and cinders as large as marbles fell in intermittent showers. A smell of sulphur dioxide added spice to the general downpour. Fortunately for me, the mountain decided not to explode that particular night. A hunt without a light for a safer or more comfortable position involved risk of a fall. Moreover, curled up like a sleeping cat, I had some chance of keeping fairly dry. Toward morning things began to calm down a bit, or my senses became dulled for I managed to snatch an hour's sleep. By seven in the morning the rain ceased.

Above, in the whirling mist, towered the slippery pile of loose rock powder called the ash cone. There is no better place on earth to acquire a vivid idea of the meaning of the expression, critical angle, or, angle of repose. Angle of repose seems a misnomer when one tries to climb such a slope, for, at the least dis-

turbance, everything tends downward. At each step the climber is made to feel the same downward pull and he begins to realize that the attraction of gravity is no laughing matter. So it was with great difficulty and with considerable expenditure of energy that I at last reached the ultimate triumph, the rim of the crater.

The first impression is intense surprise. The expected 'hole in the ground' turns out to be, not only deeper than the anticipation warranted, but of a different order of magnitude. Here is a place where one begins to feel vaguely as if in outer space with no friendly earth to comfort and sustain. I gazed into a seething, abysmal hole fifteen hundred feet deep with vertical, and in many places, overhanging walls. The sides were continually breaking away and falling like avalanches with a hollow rumble to the bottom. The edge was so sharp and so ready to fall inward, that only here and there did I dare look over into the crater. The storm clouds still clinging to the summit combined with steam from within the crater to give a weird ghostly feeling to everything.

The plentiful steam jets which permeated the ground even at this height, though somewhat of a puzzle, were convenient as hand warmers. The sun gradually dispersed the clouds and the strong wind occasionally cleared the crater from the all obscuring steam. Free to enjoy raw nature, I scrambled along the edge of the crater from the north around to the southeast, then by compass struck direct for Pompeii.

Whatever the geologists may eventually agree upon as the cause of active volcanoes, the fact remains, that nothing of a terrestrial nature can compete with their savage charm in inspiring terror in the human mind, but to get the full effect you must commune alone and at night, with the savage glowing heart of nature.

The Birth of the Yew Berry

Eva Marian Provost

A berry red o'er the brookside bent
  Telling its radiant tale,
How light and shade a tapestry made
  For its spirit shy and frail,
How sweet companion was the moss,
  How soft the breezes swayed,
Till birds brought back their vistaed songs
  And flowerets debut made.

Just Ooze and Slime! Is the Expression Fair?

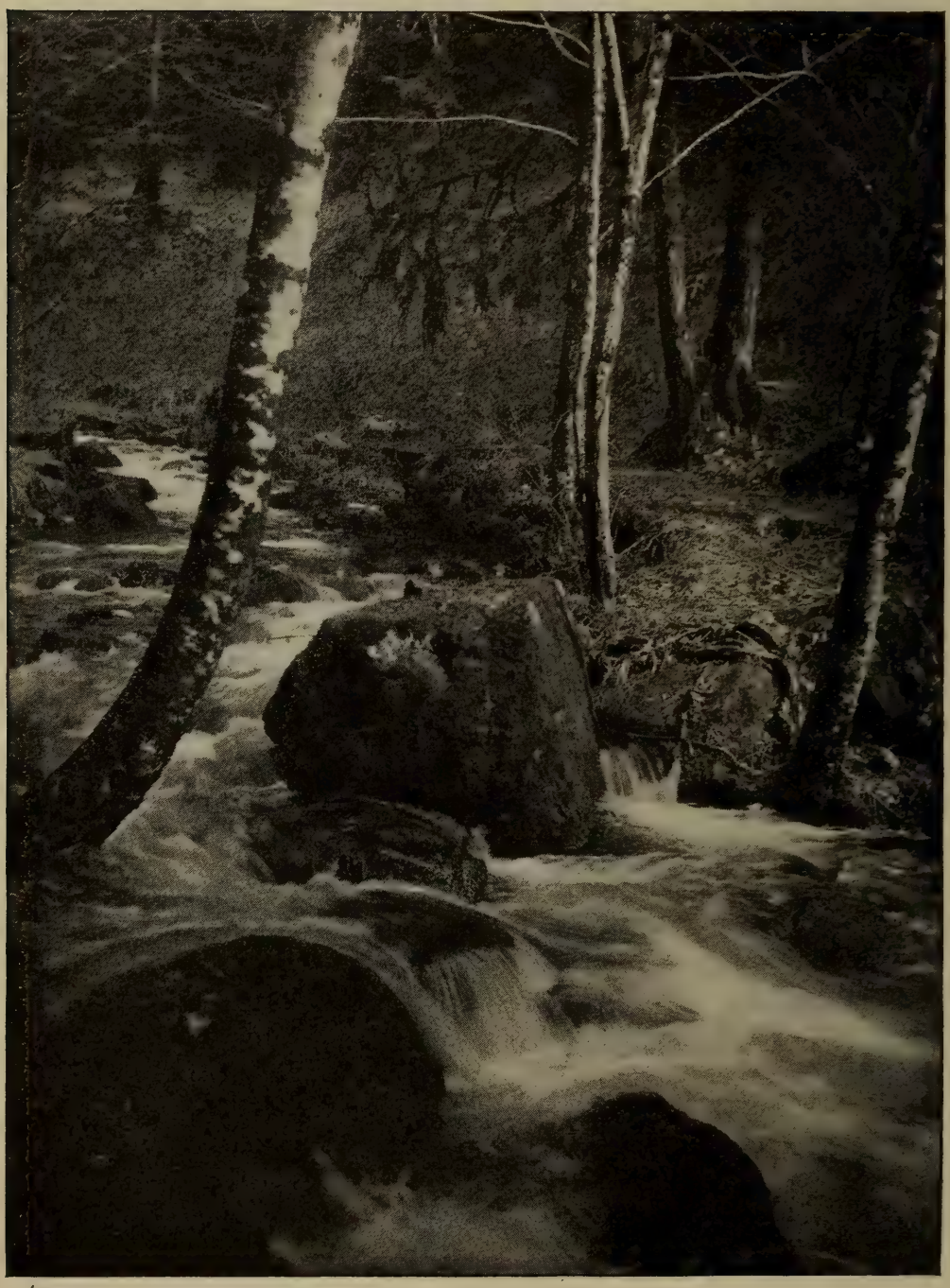
E. Laurence Palmer

Assistant Professor of Rural Education Cornell University

The person who reads this article and has not had some experience with its subject is either an exception or was brought up in the heart of a city or a desert. Even these latter may be among the many whose experiences are if such a nature that they are forced by necessity to remember them. The writer remembers a certain sixteenth of April when he was wading an icy trout stream in New York State. He was sure that if he could only wade to a definite point a bite on his hook would be a certainty. The trout never had the opportunity to bite however and the writer spent the remainder of the day trying to dry his clothing in the back room of a country store while his companions were able to sit back and gloat over the day's catch that night. The cause of all the trouble was the coating of slime which covered the rocks and reduced friction to such a point that the swiftly-slowing current did the rest.

To most of us and to the writer at that time the coating of slime meant nothing but one of the apparent inconveniences which nature seems to provide to keep life in the open from becoming perfect. It was consigned to the same category as the gnats and mosquitoes which buzzed about and stung us but which also did their part in furnishing food more or less directly to some of the very fish which called us to the stream. As the girl said when she pulled her small brother from under the sofa, however, "It's the little things that tell?" and the insignificant slime of the brook bottom and forms closely resembling it may have a further reaching influence upon the life and geography of this earth of ours than do superior (?) beings like ourselves.

It is not the purpose of this article to deal with this slime in the manner in which the systematic biologist would take it up though it forms a wonderfully large and interesting field in systematic biology. Instead the writer hopes to show how these oozes and slimes have left and are leaving their imprint indelibly on the surface of the earth and how even though some of us might consider them an evil they are a necessary evil. Even though this is a "slippery" subject we cannot evade the issue and neglect mentioning something of the life habits of these organisms.



Why should one slip on the stones in this stream?

Few of us in the latitude of New York would expect to find apple-blossoms in August, hepaticas in October or golden rod in January. We recognize that there are definite times in the year for each of these plants to bear flower and fruit and we expect them at those times. Fewer still realize that the slimes and plant materials covering a rock in a brook in January are mostly different from those growing on the same rock in July. There is a definite succession of species in the aquatic environment just as there is on land. Temperature seems to be the most important factor governing this succession. The plants growing in a spring may be practically the same throughout the year because the temperature of the water is practically uniform. but in the open stream,—ice-bound in winter and luke-warm in summer the variation is great as is the temperature. The groups found in slowly-flowing water also vary with the seasons and so the story goes.

Probably there are three ways in which these organisms may be of greatest interest to us. First, there is their influence on the quality of the water in which they grow; next, their relation as a food source to other forms of life in the water and out of it; and lastly, their influence upon the topography of the earth and consequently upon geography.

It is not difficult to say which of these is the most important as it cannot be disputed that without pure water life for us would be impossible. When we look at a stagnant pool and see it congested with floating pond scum or when we stand on a bridge over a river in the spring and see masses of a dirty jelly-like substances rise to the surface and float off down stream, it is hard to connect the presence of these plants with water purification. Yet that is exactly what their presence indicates. An increased growth of plants of a somewhat similar type near where sewage is dumped into a clean stream is due to the fact that there is a superabundance of waste-material which to these plants is food. As a result they multiply abnormally. In taking this food they give off oxygen,—one of the very best purifying agents. Sometimes they do this so rapidly that the oxygen is not used up in purification of the water. Instead it forms into bubbles sufficiently large to break masses of slime loose from the bottom and bring it to the surface.

The stones in brooks are covered with the plants whose presence adds to the amount of oxygen in water. Of course when the

water tumbles over rocks this mixture is already comparatively high in oxygen content because of mixture with the air.

Besides serving as producers of oxygen these plants further aid in the purification of water by forming a film over the bed of water courses. Before entering the earth to come out possibly elsewhere, the water must filter through this film. In so doing many impurities are prevented from entering to where the sun and open air may be prevented from changing objectionable to desirable qualities. The first water run through a commercial filter is never as pure as that coming later when this film has had time to form on the surface of the sand.

If purification of our water-supply were the only benefit gained by man from this ooze and slime, we would have to admit its importance. Further than this however, it fills a far-reaching function in supplying food to innumerable forms which are fed upon by large forms and which eventually make up the bodies of the fishes which we ourselves eat. We can even carry the step further and say that individual fish are at some time directly dependent for food upon organisms in many ways similar to the ooze which makes our footing quite unsafe.

To many a boy the idea of a house made of cookies would be the next thing to heaven, and practically an impossibility. In practically every normal brook, however, a similar condition of affairs exists for some of its inhabitants. Take a large stone from almost any brook in the spring and shortly you may see red worms (blood worms) crawling out of definitely formed masses of plant material. To them the world has suddenly gone on a strike and even though their homes are made of the material which makes up their meals they are deprived of water and attempt to get back where it is more to their liking. These forms make their houses of this ooze and are directly dependent upon it for their food. In turn they make excellent food for fishes. Pollywogs die in an aquarium containing nothing but water. Put a few ooz-covered sticks in and leave them, and they live. They are dependent upon the ooze for their existence and when they grow up we enjoy eating their legs. Too many tadpoles would sweep the pond fairly clear of ooze and so we see that one of the uses of frogs is to keep these plants from multiplying to too great an extent. All of these higher forms could not possible exist then were it not for this ooze which combines materials not acceptable or usable as

food by complex animals, into a highly acceptable form. And the beauty of it is that while bringing about a desirable food, the waste product of that process is useful in purification. What more ideal arrangement could be asked.

It is true that for one reason or another there are some forms whose desirability is not apparent. Usually, however, these forms force themselves upon our notice only when we have by some artificial means upset the balance of nature and prevented them from performing their normal function. For the inconvenience thus caused, we who upset the balance should be held responsible. Sometimes we expect too much of nature and too little of ourselves.

Aside from the food and clean water provided by ooze and slimes much of our landscape has been and is being influenced by their presence. When we make an outline drawing of a contintent we never draw it with a ruler. It always consists of an irregular waving line. This very ooze of which we have been speaking has had more to do with the shape of this line than most of us imagine. Were it not for the presence of ooze on the bottom of rivers near where they flow into lakes and oceans much of the sediment which remains imbedded in it would remain suspended for a longer time in the water. The ooze is constantly preventing debris from being carried further down stream particularly if it is at all jelly-like. Anyone can see that sooner or later a continuation of this slowing up of the movement of sediment would cause a greater and greater accumulation and would make the water shallower and shallower. Continue this long enough and marsh plants will be able to grow where once there was too much water. In time the accumulation of the bodies of the marsh plants will build up a soil on which dry land plants can grow and so the geography of the region is remarkably changed. Remember though, the first step in that change was brought about by that contemptable slime which to the most of us has no apparent significance. Similar formation of land may take place along shores where there is no sediment brought down by rivers but where waste is brought in by a rising tide, and prevented from returning by being stuck in the ooze. In this manner sooner or later land will be built up. This is true of course only when this land is protected from the lashing of waves which would tear down in storm what is built up in calm. A study ot the shore line of any continent ought to prove doubly interesting now that we realize the part this insignificant ooze plays in changing that line.

The shores of most seas of Europe furnish interesting study along this line. We do not need to go that far, however. One look at a map of Louisiana or probably at the place where some stream enters a lake near where you live should satisfy you should you be a "doubting Thomas." Once you are satisfied, a glance at any map of the mouth of a stream ought to picture ooze and slime and sediment all at work bringing about change. Whoever saw a monotonous map of the mouth of a slowly flowing river. It has changed and is changing constantly and the ooze is helping bring about this change. Is it fair then to speak or think of this interesting formation of living organisms as "just ooze and slime?"

Florida

Wm. Prindle Alexander

Here summer smiles, and yet 'tis only spring
If seasons I must reckon as of old,
But some bright fay with light and lustrous wing
Came over night, and straightway banished cold,
For jasmine here, and roses new unfold;
While robes of snow the North is covering.

For this fair garden I have waited long,
And long have hoped some subtle song to snare,
But I alas, am captive to the song
The mocking-bird sings bravely unaware,
Just overhead the while I hardly dare
Draw breath, that he his singing will prolong.

Oh! feathered darling of the South, to thee
My praise mounts up, Oh! peerless mocking-bird
How hath thy voice of rapture shaken me
When I have listened, oft, and deeply stirred,
But half believing that the song I heard
From one small throat, could so exultant be!

Here Summer smiles, Spring's reason to belie,
Each day a lovely sponsor to the rose,
Each morning glowing gladness in the sky
Each evening drawing June-like to its close,
And star-lit night in Lethe-calm repose,
Make seasons one, and time glide softly by.

ELEPHANT AT TEA

Learning Geography at the Menagerie

ETHEL HAUSMAN
New Haven Conn.

What a direct connection is the zoo or the circus menagerie between the child and the far corners of the earth where the animals and birds which he gazes at with so much interest live naturally! And yet how little has it been thought of or utilized by teachers or parents. It is another instance of ignoring on the part of the adult the open pathways which the child mind would follow so easily, leading from its own restricted environment out into the great wonderful world.

What should we try to teach in Geography, anyway? Merely the maps of countries? No, the maps may change any year but the hills, plains, mountains, and forests which they cover remain much the same, and it is not to teach the child where these countries are so much as what they are like that we should try to do. The tiger should bring to the child's mind the tangle of the jungle; the hippopotomus, the vision of great shallow rivers, the lion, the scrub covered hillocks, the brown rocks where it makes its lair; the camel, the desert with its waste of sand and palm covered oases; the llama the snow covered peaks of the Andes; the elephant, the forests of Africa and India, the pomp of native monarchs or the wide Irrawaddy covered with rafts of teak. In fact every animal and

bird in the zoo should have a background in the child's mind and imagination that would give a fair picture of its native surroundings. Then indeed would the child know real and vital things about the geography of the earth. The following studies of four zoo-animals have been made to show their adaptations to very different geographical environment.

THE CAMEL

Nature has fitted one large animal, and only one, to live in the desert,—the camel. Its large, broad feet, with cushion-like pads do not sink into the soft sand as the feet of other animals would. And although it cannot travel over the ground as fast as a horse, yet it moves rapidly over the sands, and can travel all day for several days without water, a feat which no other animal could accomplish. It also requires very little food, and thrives upon the lean and scraggly thorn bushes which it finds growing sparsely along the way. Occasionally the camel driver feeds his animal a handful of dates, but in the main the camel is able to feed on its hump. How does it do this? Does it reach around and bite off a piece every now and then? No, by feeding on its hump, I mean that the food needed by the blood to nourish the tired muscles, is absorbed by the blood streams as they run through the veins in the hump part of the back, which is mainly made up of fatty substance stored away for times of need. When a camel reaches the end of a very long desert journey, its hump has dwindled in size, but with rest and plenty of food it soon regains its normal size again. This ability to go without food and water especially fits the camel for desert life where wells are three or four days journey apart. The camel has four compartments to its stomach. One of these is lined with little water cells, and in this compartment as much as a gallon and a half of water may be stored. At times this water rises to moisten the throat and the dry lips. A camel is able to go without water for as long as ten days at a time, but when it finally does come to a well, dear me, what a drink it does take. It drinks for the past, the present, and for the future, all in one draught! The camel will travel 18 miles a day, under a burning sun, and over scorching sands and carry a load weighing as much as 600 pounds. And it does this as we have said with no water, for ten days, and with very little food. Truly it is a wonderful beast

The nostrils of the camel are provided with sphincter, or closing muscles, so that it can close its nose tight when the desert sand storms overtake it. The eyes are large and prominent, but are protected from the direct rays of the sun by heavy, overhanging lids. Because the camel is able to travel over the vast seas of sand with such certainty, it has often been called "the ship of the desert."

The mouth of the camel is lined inside with a tough membrane, which enables it to eat harsh thorny plants, which is the only kind of food that the desert affords it.

Its heavy coat is at once a protection against the cutting sand, when driven by fierce winds, and also from the heat of the sun. It is a dun, sand color, which matches well the ground over which it travels. Its long sweeping neck, and large eyes give the animal a wide range of vision over the sands.

Some confusion exists regarding the two names camel and dromedary. The camel with one hump is the Arabian Camel; and the camel with two humps is the Bactrian Camel. The dromedary is any sort of camel either one or two humped, that is swift of gait and is used only for riding, and not for pack carrying.

The Arabian Camel is the species of the desert and heat. We are accustomed to think of any camel as being fitted for desert life, but the Bactrian Camel, the northern form, is as enduring of cold as its southern brother is of heat. Caravans of these Bacrtian Camels loaded with merchandise, proceed through the snows of winter, or the heat and dust of summer between China and Russia, across the plains of Mongolia and Turkestan. Can you follow their route on the map? This beast has, for centuries been the only means of transportation between China and Russia. Sometimes as many as 6,000 camels are driven in a caravan over the great public road from Cairo, in Egypt, to Suez and Mecca. Camels carry freight or passengers, as well as food for themselves and their drivers. An ordinary caravan camel can move at the rate of about 18 miles per day, but a swift dromedary can run for seventy miles without a stop, and in 15 days can cover 700 miles! The Bactrian Camel is of great use in time of war to carry cannon. This is called the camel atrillery.

All of the products obtained from the camel are of value. The finer hair is made into brushes, and fine fabrics, and the coarser hair into tents and ropes. The hide furnishes a very stout leather.

Camel's milk, though bitter because of the wormwood which it eats, forms the staple diet of thousands of Arabians, and the cheese made from the milk is palatable and wholesome. The flesh though coarse, is good for food, and much used.

The poor camel is, however, in spite of his many good points a rather disagreeable beast. It is sulky, vicious, and stupid. Camels often cry out angrily when receiving their loads, bite and kick, and often nip the man who is their passenger when he is off his guard. The drivers are often as ugly and cruel and ignorant as the poor camels, and treat them with great harshness. Perhaps this accounts for their vicious tempers. Certainly they look wise and kingly and sober enough when we see them marching with such dignity in the circus parades.

Camels were introduced into the United States in 1850, during the time of the rush of gold seekers to California. It was hoped that they might be used to carry supplies across the plains. They proved unsatisfactory, however, because of their ugliness and bad tempers.

THE LLAMA

The llama is first cousin to the camel, which it resembles, but is smaller and has no hump. Its native habitat is the mountainous regions of Peru and Chili, where it lives at altitudes from eight to twelve thousand feet. If forced to live at lower altitudes it suffers and dies.

Llamas are small creatures, measuring three feet in height at the shoulders, and about four and a half feet to the top of the head. They are of various colors, white, brown, black, or a mixture of these. Like the camels they carry their heads erect on rather long, curved necks.

The Llama is a beast of burden. It has been domesticated for many centuries, and is not now found in the wild state, as are its near cousins the alpaca and the vicunia. These pack animal pass back and forth between the mountain metal mines and the coast, loaded with ore, or bars of metal, and return with salt and other provisions. Each llama can carry a load of about 120 pounds, and if the load is heavier they frequently lie down and refuse to move until the burden is lightened. They are lead in companies of sometimes 1,000 or more, by a few picturesquely costumed Imdians, over the native trails. To some extent

llamas have been replaced by the railroads, but still in the rougher parts of the Peruvian mountains they are used in large numbers. They can travel but about twelve miles a day, for they must feed as they go. They will not eat at night. This method of travel, though slow, is very cheap, for it costs but little to care for llamas, since they require no food except that which they pick up along the way. A llama is not expensive to purchase, either, costing about five dollars. Only the males are used as burden-bearers, the females being kept for the purpose of caring for the young, as well as for their milk, and flesh after they are killed. The Spanish conquerors of Peru spoke of llama flesh as being equal to the best of mutton, and they established in the towns, shops for its sale.

The wool of the llama, though inferior to that of the alpaca, is used for the same purposes, that is, for the manufacture of cloth, and especially of shawls. The skin is made into leather.

The llama is well fitted to live in high mountainous regions. In the first place it can endure cold weather, and can get along on what little sparse vegetation its home affords. Secondly it is able to go for long periods, like the camel, without water, and lastly its feet are so formed that they are able to climb over very rough paths, and the stout muscles of the legs enable them to jump and spring with great agility over rocks or fissures, and curiously enough it can jump either forward or backward with equal ease. Its feet are spongy, and are furnished with stout claws with which it can keep from falling when on the ice.

The Indians are very fond of their llamas, which they always fondle and caress before loading. Often they decorate their ears with ribbons, and hang bells around their necks .If one of the llamas in the pack train becomes tired and lies down, the Indian in charge can, by coaxing and petting, usually encourage it to get up and continue its journey again. In spite of the care given to the llamas, many of them from each pack-train perish in their journeys to the coast, for the weaker ones cannot stand the low altitudes and the warm climate.

Like all good animals, and good people too, sometimes, the llama has one very bad habit. When angered, it will kick and bite, and if very angry will eject upon its tormentor a mouthful of saliva, or a pint of so of undigested food from its stomach. But it does not indulge in such naughty tricks unless it has been tormented, and

then we must forgive the poor beast, for it behaves so only in self defense.

When resting the llamas make a peculiar humming noise, which when coming from a large flock in the distance is said to resemble the musical humming of a number of aeolian harps sounding in concert. It must be a lovely sound on a summer evening among the high mountain peaks!

THE HIPPOPOTAMUS

The Hippopotamus, or River Horse, which inhabits the lakes and rivers of central and southern Africa, is one of the bulkiest of all land animals, being exceeded in weight only by the elephant, and occasionally by the rhinoceros. It often attains the weight of three or four tons, and a length of eleven or more feet, yet it stands only about five feet high. Its legs, though massive, are very short, and give the creature an awkward, dumpy appearance.

Hippopotami live in herds of from five to fifty individuals. During the daytime they are seldom seen out of water, but spend their time dozing in the deep pools with only their eyes, ears, and nostrils above the surface. With all their bulk they are nevertheless, rather sportive creatures, and can often be seen frolicking like huge porpoises, or feeding upon the water plants along the margins of the streams. They frequently come out of the water when the sun is hot, and bask in its warm rays, or wallow in the mud, like so many enormous pigs. This habit, together with the grunting noise which they make when playing, or when alarmed, reminds us that they belong to the same great order of animals as the pig. Indeed they are often called river pigs. At dusk they come out of the rivers to feed, and often walk long distances overland in search of good feeding grounds. They are very destructive to crops, for they eat immense quantities of food, one often consuming as much as six bushels of vegetable matter. They trample down much more than they eat. In going to and from their feeding grounds they make regular paths through the grasses, and it is in these paths that the natives set their traps. We may well wonder what sort of useful purpose such animals serve. One writer says: "The chief office of the Hippopotamus is to keep in check the dense vegetation in the tropical climates, which, if allowed to accumulate, would block up the long reaches of rivers, and ultimately turn the flat lands into useless fever-breeding

swamps; so that we see that this gigantic animal is of very considerable importance." Hippopotami are strictly vegetarians and feed upon various water plants and reeds, as well as upon millet, maize, sugar cane, and other crops raised by the natives.

The Hippopotamus is unusually well fitted to live an aquatic life. In the first place its eyes, ears, and nostrils are all on the same level. This enables the animal to sink in the water all but the very top of its head, and so lie quite out of sight, and yet see, hear, and breathe perfectly. It is possible for a Hippopotamus to remain under water for as long a period as ten minutes, but it does not usually remain entirely submerged for more than two or three. Just fancy holding your breath for ten minutes! It is all that a person can do to hold it for one. Try it and see. Furthermore the Hippopotamus is provided with special muscles which enable it to close its nostrils and the openings into its ears when it dives. When the Hippo comes to the surface after having had a long dive it exhausts its lungs in a long and powerful blast, just as a boy does when he comes up from diving for pennies. This drives a spout of water high into the air, and resembles somewhat the blowing of the whale. Notice the feet of the beast. They are broad and flat, and the toes spread out widely, so that the creature, big and heavy as it is, can walk through the mud without sinking in too far and being caught. The broad feet are also very useful in swimming. As a protection against sudden changes in temperature, as well as to protect it from the chill of the water, the Hippo possesses underneath its skin a layer of fat, from one to two inches thick. The total amount of fat obtained from one animal often reaches a weight of two hundred pounds. This fat is much prized by the Natives. The mouth of the Hippo is well formed for sweeping in great masses of vegetation, and resembles in its size and effectiveness a steam scoop shovel! Have you ever seen a Hippo yawn? It is as though the earth itself had opened at your feet. No one who has seen a sleepy Hippo yawn, in a Zoo, can feel anything but gratitude for the stout iron bars that come between him and that cavernous maw! The teeth are often two or more feet in length.

Fortunately these hugh beasts are peaceably inclined, and do not show any temper unless angered. Occassionally they come up beneath the canoes of the natives, tear out the sides, and then crunch up the unfortunates who are thrown into the water. This,

however, occurs only when they are being hunted, or when they are protecting their young.

Their thick, pale chocolate-colored skin is rough and warty, and without hairs, except about the muzzle and at the end of the short tail. The young differ from the adults in being smaller, and paler, almost pink, in color. They ride about on the back of the mother, and are apparently ignored by the males.

The hide of the Hippo is covered with a natural oil, which is poured out through pores in the skin, and appears to be for the purpose of preserving the animal from the injurious effects of too long continued immersion in the water. This oil is reddish, somewhat resembling blood, and oozes out in large droplets. It is this which has given rise to the false notion that the creature "sweats blood." And the "Blood Sweating Behemouth of Holy Writ" is a familiar sight to all lovers of the circus.

Hippos are hunted for their hides, their flesh, and their fat. From the hides, which are from one and one-half to two inches thick, are made shields, helmets, whips, and canes; while the fat is used in various ways, and the flesh for food. The teeth, also, are valuable, furnishing an important part of the ivory of commerce.

THE ELEPHANT

The Elephant is the mightiest and most majestic of all the land animals, and one of the largest creatures that has ever lived on our earth. In fact it is surpassed in size today only by the great Blue Rorqual Whale, which often reaches a length of over 80 feet.

There are two kinds, or species, of elephants; the African, which lives in the dense forests of Africa; and the Indian, inhabiting certain parts of India. The Indian elephant differs from its African brother in that it is not so large and its ears are smaller, its head longer, with a concave forehead. Its eyes, too are not so large, in most cases. The great ears of the African Elephant are always a source of wonder to small boys, as the great beast goes stalking by in the circus parade, for they hang down far below the neck, and are so large that a man may conceal himself behind one of them with ease. The tusks of the African elephant are much longer than those of the Indian species, and most of the ivory of the world is obtained from them. It is said that about one hundred thousand elephants are killed each year for their ivory,

and yet they still exist in large numbers in spite of such terrible slaughter. The body of the elephant is somewhat stout and clumsy-looking, and is supported on strong, pillar-like legs. The usual height of the shoulder from the ground is from seven to twelve feet. The African elephant is the taller, and in each species the male is the larger animal. A full grown male often weighs as much as five tons! The tough brownish gray skin is like leather, very thick, and almost hairless. The usual color of the creature is a rather dirty brown. There is no such thing as a "white elephant" in nature. Sometimes an elephant will be covered with a coat of whitewash by some unscrupulous owner, and exhibited merely for the purpose of drawing money from the pockets of the unread, who eagerly crowd to see such a wonder. Sometimes an elephant will be found, of a light grayish color, with pink blotches about the head. Such an elephant is called a white elephant in Siam, and is looked upon with reverance. Its house is decorated with silken hangings; it is fed rare fruits from vessels of gold and silver; and when it goes out it is arrayed in silken trappings decorated with gold, silver, and precious stones, while a group of nobles shade its head with a canopy richly woven and supported by rods of gold. These white elephants are very rare, and are the result of the same cause that makes white mice and white rats, the cause being some bodily peculiarity which prevents the pigment, or coloring matter, from being deposited in the skin in its proper amounts. The skin of the elephant, in spite of its leatheriness, is very sensitive, and can detect the presence of small insects, it is said. Like the horse the elephant is provided with certain skin muscles, which enables it to quiver the skin, and shake off annoying flies, or dust.

Nearly all of us have been to circuses and have fed peanuts to the elephant. Have you ever stopped to think what a wonderful organ the trunk is, and how well fitted to serve the animal in the kind of surroundings in which it lives. It is so strong that it can lift many hundreds of pounds' weight from the ground, or uproot a small tree, or tear down heavy branches, and yet so delicate withal that it can pick a single blade of grass, or take up a pin from a smooth floor. By means of the trunk the elephant reaches high into the trees and conveys food to the mouth, or water from a stream, or squirts it over its head and body when hot and dusty. The trunk is formed partly from the nose and partly from the upper lip, and contains no fewer than 50,000 muscles,

which enables it to be stretched, contracted, and turned in every direction. The trunk takes the place of a long neck. And the elephant could never develop a neck strong enough to support the weight of his huge head and heavy tusks. The trunk serves not only as a means of securing food and drink for the animal, but also as a trumpet, for it is through this organ that the elephant emits a loud call, and likewise as a weapon of defense in fighting. And lastly, it is used for a purpose for which all noses are used, to smell with.

The tusks are the greatly overgrown incisor, or "front teeth" and are used as weapons in fighting, as well as to tear up the soil in search of roots. In the male they are especially large, the largest pair on record weighing about 450 pounds. Normally they do not weigh much more than 200 pounds. As a rule the bull with the longest and sharpest tusks rules the herd.

The elephant is a social animal, and lives in companies, old and young together, ruled by the most powerful male. Sometimes these male rulers, or bulls, get too tyrannical and are driven away from the herd. They then become very dangerous to man, and are known as rogue elephants.

Elephants have small, but very sharp eyes. Their sense of hearing is also acute, and their sense of smell very keen. They can often detect the presence of an enemy by his odor at a distance of 1,000 yards.

The food of the elephant consists chiefly of the tender shoots of trees, roots, barks, as well as grasses, bamboo, sugar cane, and reeds. Besides these it will take cultivated crops, and all sorts of soft and herbaceous plants. When not sleeping it is usually eating, and consumes enormous quantities of food. One elephant will stow away over 600 pounds of fodder per day. How many bales of hay, at this rate, would it take to feed a circus elephant for one year? Figure it out and see how surprised you will be A herd of elephants soon exhausts the supply of food in one locality and then moves on to another. When on the march they go in single file, like Indians, and move at a rapid pace, usually about fifteen miles an hour.

It takes thirty years for an elephant to reach its full growth, and it frequently lives to be over 150 years old.

The Indian elephant has become the valued servant of man, in war carrying ammunition and men, and in peace helping to

transport and pile heavy lumber, or to build brick and stone walls. He is also used in parades of the royalty or of the nobles in his native land, and in circuses and menageries in other countries. The African elephant, on the contrary, is not so amenable to kindly treatment. It is fiercer, and wilder, and seldom captured for use alive. Formerly elephants were killed by the natives by poisoned arrows, or entrapped in pitfalls covered with branches. The most common method now-a-days is to entice or drive them into strong enclosures. To capture elephants in such a manner frequently requires over 2,000 men. The natives are glad to join in such a hunt, however, for the elephants destroy their crops. The priests of certain native tribes encourage the killing of the elephants, because they tear down and destroy the sacred bo-trees.

There are many interesting accounts of how elephants are tamed after they have been caught, and of how they are taught to take part in tiger hunts, or to labor for man. It is said that the elephant is an intelligent animal, ranking next after the horse and the dog, and by some is considered superior to these; he is possessed with a good memory, instances have been known where an elephant has cherished for a surprisingly long time, feelings of gratitude or resentment.

The Cabbage Butterfly-Caterpillar Changes Color

FLORENCE E. WHITE

During this last summer (1918) an interesting thing came to my notice. In a field of Danish red cabbage, Yorktown, West. Co., N. Y., I noticed the cabbage butterflies flitting around the cabbage plants. On further investigation the larvae were discovered, but instead of being green as they naturally are, they were of a purplish tinge so similar to the leaves on which they were feeding that they were hardly noticeable. Whether the color was due to the cabbage they had eaten or whether they have some power by nature to change to a protective coloring I do not know. The seed was imported from Denmark so it does not seem possible that a foreign species could have entered with it.

THE NATURE-STUDY REVIEW

DEVOTED PRIMARILY TO ALL SCIENTIFIC STUDIES OF NATURE IN ELEMENTARY SCHOOLS

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Editorial

We think too little of the great influence which geography wields over our daily lives. It is a matter which we as teachers should emphasize. This January morning the view from the editorial windows gives a scene of the earth snow clad to the horizon, variegated with the purple patches of bare forests, and the chickadee and nuthatches are taking cheerful turns at the banquet board in the oak tree. A year ago we were looking out over the white sands of Florida and were watching the pelicans fishing while we sat in the shade of a palm and a live oak. Four years ago in California we looked out over sunny orange orchards to rugged snow-capped mountains and a varied thrush, the most gorgeous robin in the world, was finding his breakfast under the calla lilies blossoming in the garden. And ten years ago we were sitting in a garden in Luxor, Egypt, under the shade of date palms and bamboo while a great stork rattled his beak by the fountain; a gazelle peered at us from behind a hibiscus bush and a hoopoe scratched in the dust at our feet, opening and closing his crown feathers like a golden halo about his head. Of these divergent January scenes the only things in common were the skies, the heavenly bodies and the English sparrows and the differences were all due to geography. In each place the native peoples were living by the laws of geographic conditions which are as fixed as were the laws of the Medes and Persians. Every day of our lives is modified and ruled by our geography but so accustomed are we to our living conditions that we never think about it any more than we do about the air we are breathing.

Another geographic thought for us this New Year should lead us to thankfulness for the good fortune of being on our own special

map. What if it had been our lot to be placed on the map of Russia, Armenia or one of the Balkan states or upon any of the maps of Europe where there are now peoples suffering with the cold and for lack of food. Yet it has been geography more than any other factor perhaps, that has kept Europe in a turmoil of war for ages past and has put untold suffering upon innocent peoples. War in Europe, famine in India, fever in Africa have all been matters of geography. Our own geography may not always please us but we should consider what it has done for us, taking the centuries into account and be very thankful that we live on a map which covers a great amount of tilled land to give us food and that it is dotted with towns and villages the crowning pride of every one of which is a school-house.

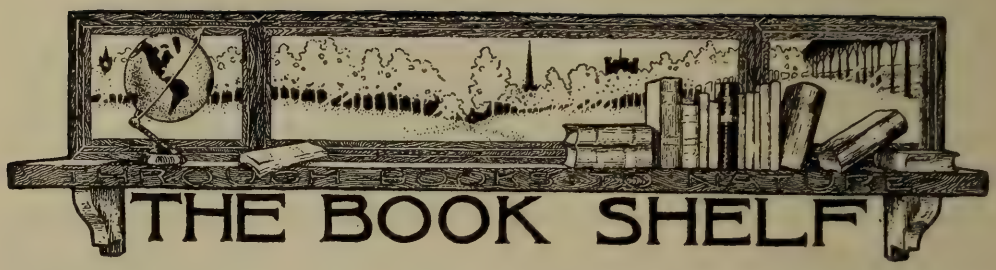
News Notes

In the last annual report of the Louisiana State Museum, New Orleans, La. is contained a most interesting account of the studies of Professor Alfred M. Bailey of a pelican survey.

The American Library Association of Washington, D. C., has published a very attractive booklet on Books-at-Work in the War During the Armistice and After. It is beautifully illustrated, showing the work of providing books for those in need in many phases of war and should be in the hands of every teacher.

The Kansas School Journal published at Topeka is a new and valuable publication given over to the educational activities, plans and ideals of education in that great state. It is attractively gotten up and bears on its cover, delightfully illustrated the following very cogent verses:

Mary had a little cold
  It started in her head.
And everywhere that Mary went
  That cold was sure to spread.
It followed her to school one day
  There wasn't any rule.
It made the children cough and sneeze
  To have that cold in school.
The teacher tried to drive it out
  She tried hard but "kerchoo-oo"!
It didn't do a bit of good
  For teacher caught it too.



Jungle Peace, William Beebe, Curator of Birds, New York Zoological Park and director of Tropical Research Station, 297 pages, 16 full-page illustrations, Henry Holt & Co.

Mr. Beebe has long been known as a writer about birds and has recently been making for himself a larger audience through his account of the life in the South American wilderness, published in the *Atlantic Monthly*. These articles are now gathered and published making a charming volume, Jungle Peace. As director of the Tropical Research Station in British Guiana, Mr. Beebe has found opportunity for studying the wilderness and its inhabitants in a more leisurely and thorough way than would be possible to the mere explorer. The book begins with a pleasant account of the voyage to Guiana with its stops at several islands. It is difficult to decide which of the following chapters is most interesting. At first we thought that it was Hoatzins at Home, a graphic account of the way these birds which have retained their reptile characteristics climb with hands and feet or dive in the river. Then we decided that the chapter on Army Ants was still more exciting. The team work of these little creatures is surely wonderful: "Here, then, were scores of ants scrambling up the steep uneven sides, over ground which they had never explored, with unknown obstacles confronting them at every step. To the eye they were ants of assorted sizes, but as they advanced, numbers fell out here and there and remained behind. This mob consisted of potential corduroy, rope-bridges, props, hand-rails, lattices, screens, fillers, stiles, ladders, and other unnamable adjuncts to the successful scaling of these apparently impregnable cliffs. If a stratum of hard sand appeared, on which no impression could be made, a line of ants strung themselves out, each elaborately fixing himself fast by means of jaws and feet. From that moment his feverish activity left him: he became a fixture a single unit of a swaying bridge over a chasm; a beam, an organic plank, over which his fellows tramped by hundreds, some empty, some heavily laden. If a sudden ascent had to be made, one ant joined himself to others to form a hanging ladder, up which the columns climbed, partly braced against the sandy wall."

However, on the whole, the chapter, Jungle Night, is the one reread most often. Note this description: "Close to my face, so near that it startled me for a moment, over the curved length of a long narrow caladium leaf, there came suddenly two brilliant lights. Steadily they moved onward, coming up into view for all the world like two tiny headlights of a motor-car. They passed, and the broadside view of this great elater was still absurdly like the profile of a miniature tonneau with the top down. I laughingly thought to myself how perfect the illusion would be if a red tail-light should be shown, when to my amazement a rosy red light flashed out behind, and my bewildered eyes all but distinguished a number! Naught but a tropical forest could present such contrasts in such rapid succession as the poor-me-one and this parody of man's invention."

In reading this book one is always impressed with the fact that Mr. Beebe has the use of all his senses, especially that of smell, surely a very important asset to the naturalist. Jungle Peace is full of interest to the Nature lover from cover to cover and we hope that Mr. Beebe will continue to write of his jungle experiences.

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TABLE OF CONTENTS

J. Andrew Drushel - - - - - - - - 47
A Neglected Side of Nature Study. S. C. Schumaker - - - 49
Samuel C. Schumaker - - - - - - - - 52
The Relation of Nature Study to Boys and Girls Club Work.
Theodosia Hadley - - - - - - - 54
Additional Science Tests in the Grades. E. R. Downing - - - 62
The Cornell Rural School Leaflet and Conservation. E. L. Palmer - 65
Nature Stories as Nature Study Material. L. M. Dougan- - - 73
Geography and Life. A. B. Comstock - - - - - 75
Cascadilla—Poem. W. P. Alexander - - - - - 81
Editorial - - - - - - - - - - 83
The Fourteenth Meeting of the Nature Study Society - - - 84
Book Shelf - - - - - - - - - - 86

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J. ANDREW DRUSHEL

THE
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VOL. 16 FEBRUARY, 1920 No. 2

J. Andrew Drushel

Professor J. Andrew Drushel, the new president of the Nature-Study Society of America, has been connected with the Harris Teachers College as head of the biological department, including nature-study, since 1905. While Mr. Drushel has made contributions through scientific investigation along a number of lines, including glacial drift beneath St. Louis loess, and loess deposits, outlining the limits of Illinoian and Kansan glacial lobes in Missouri, his greatest work has been that of teacher and leader in nature-study and science in the College and community. He not only has developed the course in science and nature-study at the College, but has taught these subjects to more than twelve hundred of the teachers in the St. Louis schools, who are now graduates of the College and who, under his inspiring instruction, are doing effective work in these lines in the St Louis schools. In addition to this he has taught hundreds of the teachers who had received their appointment before the College was established. He organized in 1910 and has been the central figure in the St. Louis Section of the Nature-Study Society of America. Through the loyal support of many teachers and principals of the St. Louis schools this section has become a large and active one. The present membership in good standing is 190 of whom many are of the original 100 charter members. The popularity of the section is due in a considerable degree, to the Saturday field trips in the spring and autumn of each year.

Professor Drushel was born Nov. 24, 1872. In his early years he attended country parochial and district schools. He received his secondary education in the preparatory department of the National Normal University, at Lebanon, Ohio. He also took normal and collegiate training in the same institution. Later he studied at Yale, taking there the degree of A.B. with Philosophical Oration rank. After graduation at Yale he taught the natural sciences for two years in the East Texas Normal College, Com-

merce, Texas, and then returned to the Normal University at Lebanon, Ohio, teaching there for four years. He has held his present position since 1905.

Professor Drushel is a member of Woodmen of the World, Masonic, and Sigma Xi fraternities. Member in N.E.A., Fellow in A.A.A.S., member of St. Louis Acad. of Sci. He has collected and studied plants in the field or herbarium in 39 states. His winter avocation is the preparation of material studied and collected in the field for illustrative purposes in botany and nature-study classes.

For several years the publishers of THE NATURE-STUDY REVIEW have realized gratefully the staunch support given to this periodical from the St. Louis contingent. This has undoubtedly been largely due to Professor Drushel's activities; his influence has been ever widening like the waves started in the educational waters always by the projecting into them a strong and virile personality. Professor Drushel has always stood for the real thing in Nature-Study, for he is an out-of-doors man as well as a laboratory instructor and his influence has been exerted to get the teachers into the fields and to see for themselves what is there. In addition to his strong qualities as a teacher he has a whimsical sense of humor that is most delightful and which enables him to deal with difficult situations tactfully and successfully. The Nature-Study Society of America is fortunate indeed to have secured Professor Drushel for its president.

"I like a man who has had an incomplete course. A partial view, if truthful, is worth more than a complete course, if lifeless. If the man has acquired a power for work, a capability for initiative and investigation, an enthusiasm for the daily life, his incompleteness is his strength. How much there is before him! How eager his eye! How enthusiastic his temper! He is a man with a point of view, not a man with mere facts. This man will see first the large and significant events; he will grasp relationships; he will correlate; later, he will consider the details. He will study the plant before he studies the leaf or germination or the cell. He will discover the bobolink before he looks for its toes. He will care little for mere 'methods'."—*The Nature-Study Idea.*—L. H. BAILEY.

A Neglected Side of Nature-Study

By S. C. Schmucker

Being the Address of the Retiring President of the American Nature Study Society held in connection with the American Association for the Advancement of Science. St. Louis, Mo., Dec. 28, 1919.

The student of nature need never lack for material. The whole world lies before his door, and is full of all manner of inviting things. When we want to lead young people into this field as a part of the school work, certain underlying requirements condition our selection of objects for study.

To gain the ends sought to be achieved by this form of training, the object considered should be familiar, and not strange; an every day object rather than a far-brought "curiosity." In addition to this, the material should be either large enough or abundant enough so that every pupil can see it clearly. As we cannot always work out of doors, the material must be such as can be brought into the room without disorganizing the school or repelling the children. The material must be inherently interesting, or the attention paid to it will be so artificial as to leave little impress. Last of all, the knowledge gained from the study should be worth while.

What could fulfill all these requirements better than—the pupils themselves. Of recent years I have been getting the class to study its own members. They find nothing that interests them more.

The aspect in which my students like best to study each other is with regard to their racial composition. By this I do not mean the admixture of white, black and perhaps in some cases of red blood the pupils have in their veins, but the proportion of admixture of the three sections of the white race inhabiting Europe, and from which we derive our ancestry. My own interest in this topic was created by reading Ripley's "The Races of Europe." Since making the acquaintance of that book I have steadily indulged the habit of studying people, especially my pupils, endeavoring to untangle the riddle of their bodily characters.

The three elements to be recognized in our European ancestors and hence in ourselves are the Nordic, the Alpine and the Mediterranean. Of these, the Nordic is the most striking in appearance. Tall of stature, commonly not very stout, with fair hair, either flaxen or red, and blue eyes, the Nordic type is unmistakable. These people are prevailingly "long heads." That is if, with the

calipers you measure the greatest width of the head from side to side, this will be found to be but seventy-five percent or less of the greatest length of the head from front to back. Looked at full at front, the face is readily seen to be high and narrow, and its sides approximately parallel. Seen from the side the head is long from front to back. Where this shape of head is excessively developed it is sometimes scornfully called "hatchet-faced."

This type of body prevails in Northern Europe. It is mixed with other blood in Norway and Sweden, is often found fairly pure in North Russia, Lithuania, Ukrainia, North Germany, England, Scotland, and Northern France. From this region tongues of conquerors of this group have gone into Middle Europe and here and there have crossed the Alps.

In our own country we find these people settled across the northern part of the United States, stretching from the New England "Yankee," to the Dakotan immigrant from Scandanavia. The middle West has many examples, and occasional members will be found in any school of considerable size. To this group our students owe blue eyes, light hair (including red) and tall stature, whether they are found pure or admixed with other qualities belonging to another of the three strains.

The second great ingredient in our composition is the Alpine. The people of this group occupy a central wedge-shaped strip across Europe, usually in the highlands. This wedge is broadest in Russia and the Balkans, runs across Austro-Hungary and South Germany and ends in a point in France.

The people of this section are purest in the Eastern end, where they are dark complected, have dark brown, rather straight hair and brown eyes. In the Western End the complexion is lighter and the hair is of a lighter brown while the eyes often are blue or grey. These people are always of medium stature and of rather chunky build. Their heads are "round," being more than eighty per cent. as wide as they are long. Looked at full in front, the face is rather square. Seen from the side the head looks short from front to back.

In this country this type is most commonly found amongst the people who are lighter and of German descent, or of the Polish, Hungarian, or Balkan peoples, who are distinctly darker.

The third ingredient, only beginning to be very common in America, is the Mediterranean. These people are short of stature

and are usually slender. They have black hair, black, often very "snappy" eyes and have olive touches to the complexion. The head is "long," its width being typically less than seventy-five per cent of its length. In this respect is is like the Nordic. But the front view does not show the "hatchet" face, but has the inverted egg form so common in the Italian Madonnas painted by Raphael. This group is at its purest in the lower part of each of the three Southern Peninsulas of Europe. But it is not confined to this region. It has spread into Austria and Rumania, and particularly into France and the British Isles. Here it is much mixed with Alpine and Nordic, but can still be frequently distinguished especially in the Welsh, less so in the Irish.

In our country it shows short stature and slight build, black eyes and black hair, in almost any region. It of course is best seen in the Italians and the Greeks who sell us our fruit and our candies.

My own method in this study is to pick out of the class the best representative of each of the three elements. In each case I tell what alteration would be needed in this person to furnish a perfect type. Sometimes I take two people, and say "Take this and this from the one and this and this from the other and you have the type." Then I take a few examples from the class and describe each, one may be Nordic with a touch of Alpine; another half Nordic and half Alpine; another Mediterranean with a touch of Alpine; occasionally, especially amongst the Irish we find one, half Nordic and half Mediterranean. Then I get each student to study himself.

I am very careful not to show any preference between the types. Indeed I think I have none. The adventurous Nordic, the persevering Alpine, the vivacious Mediterranean, each has qualities we may well desire in ourselves and in our children.

Of course this study has little of interest for very young children, but as soon as they begin to take up the Geography of Europe, this feature of pupil study is distinctly interesting and helpful.

I am teaching teachers. I find them tremendously interested in this analysis of themselves. It remains for them to adapt it to their own purposes in their own schools, where I hope and believe it will come to be equally interesting.

Dr. Schmucker in the Field

Samuel C. Schmucker

For two years Dr. Schmucker has been President of the Nature-Study Society of America and has given to it the benefit of his influence and experience as far as possible, although the two years past have afforded small opportunities for the carrying on of peaceful enterprises and Dr. Schmucker was inevitably absorbed in the work which the war forced upon educators and men of action.

Dr. Schmucker was born in Allentown, Pa., Dec. 18, 1860. He was educated at Muhlenberg College, receiving there his A.B. degree in 1882, his A.M. degree in 1885, his M.S. degree in 1891. He received his Ph.D. degree at the University of Pennsylvania in 1893. He began his teaching as Professor of Natural Science at Carthage, Ill. Afterwards he taught in the Boys' High School in Reading, Pa., and in the State Normal School at Indiana, Pa. In 1895 he was made Professor of Biology in the State Normal School at Westchester, Pa., the position which he still holds. He has spent much time delivering popular lectures . He is the author of several charming and inspiring volumes, notably "Under the Open Skies"; his "The Study of Nature" is especially helpful to teachers.

Dr. Schmucker's contribution to the Nature-Study movement has been a notable one. Uncle John Spencer once said of him,

after listening to him for an hour and witnessing the way he held spell-bound a large audience at Chautauqua, N. Y., while giving the simple story of the dandelion: "Dr. Schmucker is the evangelist of Nature Study; the rest of us work and plod but he preaches the gospel of Nature and lets in the light on indifferent and benighted souls."

We asked Dr. Schmucker to tell us of his present interests and the following is his answer:

"As to my work, the part of it on which I lay the stress myself is that of the teacher. I was prepared and equipped to be an investigator. I longed for it. But steadily the vision withdrew and in place of it loomed up the work to which I have been 'called' that of making science plain to the untrained in science. Often this means to people of very limited education. I never give up an attempt when once I undertake it, to make anything I really understand myself, plain to anybody who really cares. This has given me what place I have in the lecture field. I am staff lecturer in Biological science in its various phases, whether unofficially or officially, for The University Extension Society of Phila., The Wagner Free Institute of Science in Philadelphia, The Brooklyn Institute of Arts and Sciences, the New York Board of Education in its Department of Free Lectures to the People, and of the New York Chautauqua. This is my life outside of the class room. Last year I lectured 174 times outside of my classroom not including my classes at Chautauqua, as lectures. So you see, whatever I am doing, I am doing hard. I regularly hold six classes a day five days of the week here in the Normal School."

"President Eliot once said that he had often reflected on the problem of why one person is a successful teacher, while another of equal knowledge, talent and character fails. As the result of much observation he had concluded that what makes a teacher successful is the power to impart joy. The end of a teacher's work should be to inspire in the pupil joy in learning, joy in the possession of truth. This is not a lower aim than some other conceivable one, but the highest of all, for joy is the highest end of the universe, the final purpose of God himself."—F. C. PORTER.

The Relation of Nature-Study to Boys' and Girls' Club Work

THEODOSIA HADLEY

Western State Normal, Kalamazoo, Mich.

One hears from all directions that our system of education needs a French revolution to stir it to its depths. The statistics collected by means of the draft prove that our methods are inefficacious.

When the subject of draft statistics is broached we begin to groan. But if the figures of the draft disclosed complimentary facts regarding our educational methods, we should probably be pleased to hear them again and again.

It is some time now that educators have realized that we have passed thru our last phase of vocational education and have suggested a change in educational methods that will connect school training more closely with the life and the work of the people. A change that will bring the school to the home and tie together the book-learning of the one and the doing of useful things of the other. In other words keeping Dewey's definition of education before us. "Education is not preparation for some sort of life: it is life itself."

The thinking people of the U. S. are concerned over the lack of Americanization of our hordes of imigrants. The close relation of the school and the home will Americanize our foreign population and assist in relieving the present unrest, more quickly than teaching English in night schools.

What subjects of the school curriculum now being taught, are best adapted to bring the school and the home in close contact? Nature-Study and Boys' and Girls' Club work produce that bond between teacher, school, pupil and parents as no other subject taught.

Show the children the wonders of Nature. Lead them to appreciate how beautiful and wonderful a thing is a lettuce plant. Teach them to grow that lettuce plant in the most economical way and market it to the best advantage and we have that combination of useful book learning brought to the home.

Nature-Study and Boys' and Girls' Club work *properly taught*—produce that balance and that sympathy for American institutions for which we are all seeking.

With such an aim for our work the ideals of Nature-Study and the ideals of Boys' and Girls' Club work should be similar. But as they are being taught now, they are not.

The Nature-Study teacher has two groups of ideals as the background for his work. First the social benefit to the community at large and second the individual development of the child.

Let us cite a few instances that will remind us how a teacher can be of use to a community thru Nature-Study work. How large a proportion of our population knows the economical importance of the mosquito, the fly, the rat, the bird?

Our eagerness to Americanize our people can be satisfied to a certain extent, right here in a most beautiful and unostentatious way. Teach the boys and girls the romance of the building of the Panama Canal. France, who has done such wonderful things, failed in building the Panama Canal because she did not fight the mosquito. Any child will be fired with enthusiasm for his country, when he learns the story of Dr. Lazear and his brave associates who offered their lives in the fight against yellow fever, by permitting themselves to be bitten by a mosquito.

Here we have one instance where America has made the world a better place to live in. Yellow fever, as a plague, has been conquered thru the knowledge of the life history of the mosquito. By becoming acquainted with the mosquito, the building of the Panama Canal was made possible. The Panama Canal brings Europe, the Americas and Asia nearer together by thousands of miles. The better acquainted we become with the peoples of the world, the better we shall understand their point of view and the less possibility of war will be the result. The influence of the life history of the mosquito is boundless.

Does the bureau of public health in your city have a chart of the open vaults? The nature-study teacher is not doing his full duty unless there is such a chart. Locate the cases of typhoid fever. Is there any relation between the dots on the chart and the illness of the neighborhood? In most cases there is a connection and the connecting link is the fly.

The relation of rats to bubonic plague, of mice to the enormous loss of grain, of birds to the consumption of weed seeds—all connect nature-study with the interests of the community. They make the bond of school, home and town closer. Any spark of civic or national pride kindled in the boys' and girls' will build the fires of Americanization.

Second, the ideals that a nature-study teacher should have in his work with the individual child, are more interesting probably, because they deal with the child himself.

It is common knowledge that people do not see what they look at. It is not necessary to dilate upon what the average person loses in walking to school or to business.

It is amusing to ask a class how a robin moves, when he does not fly. He always hops at first. Then some more observing member of the class will say that he runs. How does the sparrow move when he does not fly? The first reply is that the sparrow also runs when he walks. Ask a child to draw a dandelion leaf. There will be leaves on the board resembling everything from a possible maple leaf to a willow.

It becomes a great game to catch some one who does not know what something in his back yard looks like. Incidentally this develops an interest in one's back yard. The game becomes contagious as the discoveries are brought to mother and daddy.

It is also common knowledge that the majority of our children do not go to school beyond the 8th grade. It is also true that the majority do not go beyond the bound of their own county during their life time.

A child leaving school at the eighth grade does not read easily enough, or know enough about books, to spend his spare time reading.

The laboring class is demanding a six hour day and less production per hour. Suppose a laboring man works six hours, sleep nine hours, what is he going to do with the other nine hours of the twenty-four?

If he has been taught a love for the growing things in his back yard. If he has learned to be interested in the bulletins of his state and country, which he can have for a postage stamp, he will not spend so much time at the movies and in the cigar stores. In fostering in his pupils a love for flowers, vegetables, live stock and an interest in insects a nature-study teacher has developed in the child a love for his soil and for the country that soil represents.

With the pernicious owners of automobiles and the low grade movie there has arisen a moral problem among boys and girls that did not exist ten years ago. Nature-study is not a panacea. But nature teaches lessons of morality. Nature shows that a life adapting itself to the good of all concerned and to its environment.

prospers. A life that does not conform to the laws of nature, sickens and dies.

Our poets, our artists are nature lovers. Many of them lived their formative years close to nature. All the great prophets who have given religions to the world have evolved their tenets in communion with nature.

The child who is taught the dignity of life, the sacredness and beauty of sex, the instinct of mother love in the potato bug and the cabbage worm, will have a moral background that children ignorant of science will not have. Nature-Study and Boys' and Girls' Club work are the only subjects by means of which the above facts can be naturally developed.

The average citizen has been too busy with his individual cares to have his ear close enough to the ground to detect the menace of Bolshevists, the Reds, the I. W. W.'s. How many meetings are being held in your town? How much of this propaganda is being accepted by your laboring class?

An ignorant man, or a man who is too lazy to think for himself, or a man with a certain amount of keenenss who has never had his powers of observation and logical deductions developed, is a menace to society and is a prey to these doctrines.

It is sickening to be among such men and realize how distorted is their point of view and what bold lies they will swallow as the truth.

Real Nature-Study, not sugar coated science, teaches the child to observe. It teaches him to make his own deductions from his own observations. It teaches him to think for himself and be independent of manufactured propaganda. No other subject thru the eight grades develops this independence of thought.

Go down town Saturday night in any small town or the cheaper districts of any city. What would be the general description of the American race as it throngs the sidewalks?

They are sickly, pasty-faced, hollow chested, undersized, over dressed specimens trundling a go-cart which contains as poor a specimen of babyhood.

Here again Nature-Study will assist in remedying the wrong. The nature-study trips in search of specimens, the out-of-door life in caring for plants and animals, day in and day out for six years of school life is bound to leave its impression. It develops a love for the out-of-doors and establishes the habit of seeking relaxation

in the open air. Instead of little runts, filled with nicotine and caffein, there will be men, with their chests expanded by fresh air from out-of-door exercise.

We have touched some of the ideals that embody nature-study. We have recapitulated the advantage that nature-study, *properly taught*, will bring. To develop these ideals there must be teachers who appreciate the ideals and who are interested in the problem. We do not ask teachers to teach reading who cannot call words themselves. We do not ask teachers to teach arithmetic if they do not know the multiplication table. Yet principals think nothing of asking teachers to teach nature-study who know no science.

With this most essential hue and cry for proper compensation for teachers there should also be the demand, which is just as necessary, for better teachers with better preparation.

In the schools of today, and good schools too, a dry emasculated kind of science, labelled nature-study, with no suggestion of the nature-study point of view, is being given to children and to normal students.

It is not within the scope of this paper to discuss the pedagogy of nature-study. There should be, however, a definite understanding among the believers in nature-study as to just what they consider essential in the nature-study course and then see to it that it is enforced. This is done by state superintendents of education in connection with many other subjects in the curriculum. As we are aware of the importance of nature-study why do we not insist upon similar definite demands?

The ideals of Boys' and Girls' Club work are divided between two groups of instructors. One group is the far-seeing idealist group, that is gradually learning the nature-study point of view. The other group is the product of the agriculture schools.

The first group is interested in human instincts or rather is interested in offering a proper channel thru which those instincts may have expression. The instinct to fight is satisfied by fighting against insects, diseases and other elements of failure connected with club projects. The instinct to build finds vent in the handicraft work of the clubs. The instinct to nurture is satisfied thru the care of the living plants and animals of the club projects. The instinct to cooperate, to work in bands or gangs is satisfied by the club idea. The instinct for rhythm is satisfied thru the club games which always follow the club meetings.

This group of club workers recognize the danger of a narrow trade-training, while at the same time they have not lost sight of the necessity of a broad cultural training for our future citizens. The national motto, the 4 H's, shows the ideals of this first group:

The Head—to think, to plan, to reason.
The Hands—to be useful, helpful, and skillful.
The Heart—to be kind, true, sympathetic.
The Health—to resist disease, to enjoy life, to make for efficiency.

The ideals which are the background of nature-study teaching and those of club work should be the same as the same results can be obtained. The most advantageous kind of club work is a division of nature-study. If the nature-study ideals are not held as a background for clubs, the children are losing the best part of the possible results.

The home project of vegetable garden, pig club, poultry club, carried on by school children, under the supervision of the teachers, bring the desired end of close cooperation between school and home. The formal education received at school is put into practical use at home.

Similar to nature-study work the club work develops a community spirit in the interest it creates in improving the home surroundings. The back yard cannot be a rubbish heap if there is a club garden in it. If parents know that the club is coming to visit Mary's garden, or rabbits, or chickens and compare them with the garden, rabbits or chickens, of ten of her school-mates there will be pride in having just as pretty a front yard, just as neat a back-yard as any of the neighbors. So again thru love of the soil, pride in the home, interest in the neighborhood we are helping to solve our problem of Americanization.

Club work develops observation. One must have sharp eyes to detect aphids before they become a menace. Club work develops independence, thrift in children. Well supervised club work always produces a balance on the right side of the ledger; 60% of the club members in Michigan who finished their projects, had bank accounts last year. Nothing develops independence and stability as a bank account. It is also interesting to note that children who know how their money was earned are not apt to spend it carelessly. Club work shows the nobility of work. There can be no lucky fellow who can slip thru without working

and still have as productive a garden or as healthy a pig, as the hard worker. Club work permits the broad-minded boy and girl to excel and so gives them courage and inspiration to remain in school. It also proves to the child the usefulness of reading, spelling, writing and arithmetic. It is a good thing to know how to read or one cannot read the government bulletins that are such a help. It is a good thing to know how to spell and write or one cannot write letters to ask for these bulletins or to ask for special seeds or stock. It is also a good thing to understand arithmetic or one cannot figure one's accounts.

The same advantage in healthfulness holds good in club work. The successful garden of the boy or girl makes the father want to show what he can do in gardening. The man who works in a noisy mill or smoky forge or foundry can find no recreation that will build him up physically and refresh him as gardening. Incidentally there are fresh vegetables for the home table which means less meat and which in turn means healthier bodies.

Again we have the same influence along moral lines. Besides the moral development one secures true love of nature by living closely to her, we have the added advantage of occupation thru the summer months. In these days of colossal expense most children are obliged to work during vacation. Some are working in an environment that is bad for them, both physically and morally. Some are working for small wages. Many club children cleared over $100 in club projects last year and they did it by working right in their own back yard and were discussing their problems with children of their own age.

A man's early training influences his character in after life. A man of honesty, industry, integrity and ability is the man who learned, when a boy, to be industrious, regular, prompt and to finish faithfully a given task. Club work develops these characteristics in a boy and helps to produce a good citizen.

The second group of club leaders is largely interested in the economic value of the work. They are largely the product of the agriculture college. It is the business of the agriculture colleges to produce farmers and the students are given the economic point of view entirely with no mention of the ideals of nature-study and no training in pedagogy. They claim that the economic system that is running society today is not interested in life fulfillment. The few men who are dominating business want willing efficient

workers who are tractable, with no ideas of their own. A life with vision, with the potentiallity of being a full life will object to the efficiency of the machine and will rebel against the restrictions of being a mere cog in the machinery. Their aim is to train a boy to be able to pick out the best pig in a car load and to make the most money from his potato patch. They are more interested in the pig and the potato than they are in the boy because they know more about pigs and potatoes than they do about boys.

Americans are already too practical. We have neither the poise nor the background to enjoy solitude or repose. We have made efficiency our God. We are interested only in action, accomplishing the thing that works now. Let tomorrow take care of itself.

The above point of view is partially responsible for our present unrest. Modern thought is placing less emphasis on material consideration. It is recognizing that the basis of national progress, whether industrial or social, is the health, efficiency and spiritual development of the people.

We have seen that the ideals of nature-study foster the health, efficiency and spiritual development of the people. We have also seen that the most efficacious side of club work is intimately allied with those same ideals.

Again the pedagogical point comes up. Nature-study teachers and club leaders should have the scientific subject matter necessary for such instruction. It is equally important that these teachers are given the nature-study point of view. In each normal school there should be a required course in nature-study giving the prospective teacher the material and the method.

There should also be a required course in club work that will give the material of club projects and the broad point of view that will give the children all the benefits of club work. Then we should go one step further. We should insist that no one may teach nature-study or be a club leader until he has had the above training.

It will be better for the child and for the subjects under discussion if fewer schools have the work and only those schools which have the adequate teaching force give the work.

The Results of Additional Science Tests in the Grades

Dr. Elliot R. Downing

The University of Chicago. The School of Education

The teachers of elementary science in the grades have now at their disposal the Gary science tests published by the General Education Board, 61 Broadway, New York, N. Y., with reports on the tests given at Gary by O. W. Caldwell, which may serve as the basis for comparison with the science instructions in other schools.

The attempt was recently made to try out some of these tests used at Gary in the elementary school in the School of Education for the purpose of making such comparisons. Tests Numbers 5, 7, and 9 of the Gary series were given in the seventh grade of the elementary school. While the number of pupils involved in the tests given at Gary were not numerous enough to standardize the tests, and while the number of pupils in the seventh grade of the Elementary School was not great enough to reach more than tentative conclusions, the results are nevertheless interesting and point the way to similar comparisons that may be profitably made in other schools.

Test No. 5—11 possible points

7th and 8th grade—Gary		7th grade—School of Education
76 boys	Gary	scored 5.6 points
26 "	School of Education	3.8 "
92 girls	Gary	6. "
24 "	School of Education	3.4 "
168 boys and girls	Gary	5.8 "
50 " " "	School of Education	3.61 "

High School Freshmen at Gary and at the School of Education

29 boys	Gary	scored 5.6 points
43 "	School of Education	4.7 "
37 girls	Gary	5.8 "
31 "	School of Education	4.8 "
66 boys and girls	Gary	5.7 "
74 " " "	School of Education	4.78 "

Test No. 7—16 possible points

7th and 8th grades—Gary		7th grade—School of Education
75 boys	Gary	scored 3.8 points
19 "	School of Education	4.3 "
91 girls	Gary	3.4 "
26 "	School of Education	4.8 "
166 boys and girls	Gary	3.6 "
45 " " "	School of Education	4.6 "

High School Freshmen at Gary and at the School of Education

29 boys	Gary	scored 5.5	points
32 "	School of Education	6.5	"
37 girls	Gary	5.7	"
22 "	School of Education	5.5	"
66 boys and girls	Gary	5.6	"
54 " " "	School of Education	6.1	"

Test No. 9—13 possible points

7th and 8th grades—Gary		7th grade—School of Education	
79 boys	Gary	scored 3.4	points
16 "	School of Education	2.9	"
95 girls	Gary	1.8	"
26 "	School of Education	2.6	"
174 boys and girls	Gary	2.5	"
42 " " "	School of Education	2.8	"

High School Freshmen at Gary and at the School of Education

29 boys	Gary	scored	5.4 points
25 "	School of Education	5.	"
36 girls	Gary	4.2	"
14 "	School of Education	3.2	"
65 boys and girls	Gary	4.8	"
39 " " "	School of Education	4.4	"

The second series of tests were given to the pupils of the fourth and fifth grades of the School of Education, Elementary School. The purpose of these tests was to see how effective the instruction has been in elementary science in the first four grades. Certain common objects to which attention had been given in the course of study were selected, and either the objects themselves or pictures of them were mounted on cards. There were twenty-one of these mounted on two large cards. These objects were as follows:

No. 1—A twig of Horse Chestnut
No. 2—A pod and 3. a twig of the Black Locust
No. 4—A small bottle containing seeds of pumpkin
No. 5—A small bottle containing seeds of nasturtium
No. 6—A piece of Granite
No. 7—A piece of Mica
No. 8—A photograph of Lombardy Poplars
No. 9—A photograph of an American Elm
No. 10—A colored picture of the American Goldfinch
No. 11—A cocoon of the Cecropia Moth
No. 12—A colored picture of the Mourning Cloak Butterfly
No. 13—A bur of the Cocklebur
No. 14—A colored picture of a Hyacinth plant in blossom
No. 15—A picture of Sheep
No. 16—A colored picture of the Brown Creeper
No. 17—A colored picture of Larva of the Monarch Butterfly
No. 18—A colored picture of the Cecropia Moth
No. 19—A small skein of Silk
No. 20—A photograph of a Snail crawling
No. 21—A photograph of a Grass-hopper

These cards were made up in duplicate so that each pupil could have the cards. They were laid face down on the pupil's desk together with the following blank:

You are given two cards on which are mounted certain objects and pictures. Do not turn the cards over until you have filled in the following blank:

Your name.....Boy or Girl.....Your grade in this school.....How long have you been in this school, 1 yr., 2 yrs., 3 yrs., 4 yrs., 5 yrs., 6 yrs., 7 yrs., 8 yrs. Look at the clock and enter here the time at which you begin now to look at the pictures and objects..... Turn the cards over and answer the following:

1. Is the twig of a tree. What tree?.....
2. Is the pod of a tree and 3. the twig from the same tree. What tree?.....
4. What kind of seeds are in this bottle?.....
5. What kind of seeds are in this bottle?.....
6. What is the name of this rock?.....
7. What is the name of this stuff?.....8. What kind of tree is this?.....9. What kind of tree is this?.....
10. What is the name of this bird?.....11. What is this object?.....12. What is the name of this butterfly?.....
13. What plant does this come from?.....14. What is the name of this plant?.....15. What kind of animals are these..... 16. What is the name of this bird?.....
17. What is this animal?.....18. What is the name of the animal?.....19. What is this stuff?.....20. What is this animal?.....21. What is the animal and what is it doing?.....

When you have finished enter here the time when you finish.....

Thirty-four pupils were given the test in the fourth grade and thirty-one in the fifth grade. The average score for the fourth grade was 7.88 points out of a possible 21, the average for the fifth grade was 7.95 points. The total points for each question for the sixty-five pupils is as follows:

1..... 0	7.....14	12..... 5	17.....26.5
2 and 3 ..... 1.5	8.....28	13..... 3	18.....16.5
4.....24	9.....29	14.....26	19.....46
5.....16	10.....28.5	15.....63	20.....61
6.....31	11.....30.5	16..... 9	21.....54
			22. 0

The highest score of any pupil in the fourth grade was 12.5 points, the lowest 3. The highest score in the fifth grade was 11.5 points, the lowest 4. To see if there was any difference between the pupils who had been in this school for some time and those recently enrolled, the average number of points scored by those who had been in the school three years or less was compared to those who had been in the school four years or more. In the fourth grade the former group scored on an average 7.45 points, in the latter 8.62 points. In the fifth grade the score for each group was 8.

How The Cornell Rural School Leaflet Hopes to Teach Conservation Through Nature-Study

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For the benefit of those who know nothing of *The Cornell Rural School Leaflet*, a brief introduction will not be amiss. This publication is issued by the Department of Rural Education of the New York State College of Agriculture. It is designed to furnish part of the subject matter for the New York State "Syllabus for Nature-Study, Humaneness, Elementary Agriculture and Homemaking." The work in Elementary Agriculture and Homemaking is carried on by Home Projects, the subject matter for which is published in a special series of manuals under the direction of the State Leader of Junior Extension. *The Cornell Rural School Leaflet* furnishes assistance in the teaching of Nature-Study and Humaneness. The material published in the *Leaflet* furnishes a background for that published in the Home Projects series and attempts by means of definitely organized work to show how directly dependent rural life and civilization is upon an appreciation of the forces present in the rural environment. This material reaches about ten times as many individuals as avail themselves of the Junior Home Project Work. The responsibility as to the selection of a proper policy is accordingly greater.

Four numbers of the *Leaflet* appear each year. Of these, three are children's numbers, the other being planned to help the teachers primarily. One of each of these numbers is distributed to each rural school in New York State without request. This number becomes the property of the school library. Provision is made in the teacher's number whereby additional copies may be secured by the New York State rural teachers so that each child may be supplied with a copy of the current children's numbers. The demand has been so great that for the most part requests made for the *Leaflet* by city teachers and by teachers outside the state cannot be granted. Space does not permit further discussion of the organization of the publication.

We hear so much of the words "Conservation" and "Patriotism" these days that an outline of the policy to be followed by the *Leaflet* in teaching conservation and patriotism should prove interesting.

It is easy enough to say to a teacher, "Teach conservation" or "Teach patriotism" but it is another thing for that teacher to instil into her pupils the spirit back of these words. This cannot be done by the teaching of definitions or by requiring that children memorize set rules drawn up by others. Greater reliance may be placed upon the individual who comes to a conclusion himself as to what is right and what is just than upon the one who learns a statement but has no evidence to back up the truth of that statement.

The editor of the *Leaflet* aims to teach conservation and respect for natural and civic laws by organizing nature-study material in an attractive and logical manner. If this is done effectively a child following the work cannot help but realize that besides being responsible for his own prosperity he owes a similar responsibility to others; that he is a part of a balance which for his own happiness and that of others of this and future generations must not be upset.

Each of the children's numbers is organized in such a manner that that part appearing first may be used by the younger children. The most difficult material is placed last. In this manner a child may grade himself by the extent to which he may master the material given. Each number aims to deal with one particular field of nature-study so that the nature-study period in the rural school will have a unity of interest, the difference being merely a question of the amount of ability necessary to attain the ends asked for in the outline.

Tobe more definite an outline of the organization of the subject matter in the January and March numbers of this year, may prove practical. The January number aims, primarily, to teach the relation of fur-bearing animals to man's interests and the March number aims to teach the relation of natural water resources to man's interests. To avoid confusion let us consider the January number first:

In this number a great deal of weight is given to the study of tracks of mammals and birds in snow. To assist in this a page is given showing the tracks made by the common winter mammals and birds of New York State. In each case the form starts from a stand still and proceeds at an increasing rate of speed to the right. To assist further in identification two pages entitled "From the Gang-plank of a New York State Noah's Ark" show the appearance of the imprint made by each bird's foot and by the fore and hind foot of each mammal. These pages are used to assist in inter-

preting tracks found in the field and also in interpreting the four "Problem Pages." These record experiences of different animals and birds by showing the tracks they would make in going through these experiences. The first of these pages is a simple exercise which children in the lower two grades can solve. The others are increasingly difficult. These exercises have been tried out by the Editor with children in the schools of Iowa and are not graded entirely by theory.

Aside from the "Problem Pages," directions are given whereby the child may interpret the movements of these animals by thoughtful imitation, not by guess work. Once these imitations are solved games are given where the perfection attained may be demonstrated. Further evidence that the children have mastered this part of the work may be gained by following directions for blackboard and seat work. In some of these the children write experiences told by a member of the class but instead of writing by the orthodox "Palmer method" this "Palmer method" requires that pictures of the tracks be drawn to tell the story.

Another feature in the January number consists in four pages which when cut out and pasted together make a landscape showing many types of environment. Two additional pages give outline drawings of common winter mammals. These are all on paper which will take watercolor. Proportion between the size of animals and the landscape cannot be conveniently preserved. If the children follow the directions and adopt the practice of placing the cut out animals only in those parts of the landscape where the animals themsleves or their tracks have been seen the desired end will be attained. This practice is bound to lead to a realization that each part of the landscape has a particular form dependent upon it or vice versa each part of the landscape is dependent upon a definite form to control its enemies. This principle influences all agricultural practice, and conservation.

A story for the little children about the "Three Friends"—(the downy woodpecker, chickadee and nuthatch) also creates the same idea. The names of the birds are not mentioned in the story but descriptions of their antics and the part of the landscape to which each bird attends emphasizes that in Nature-Study the important thing is not the name of individual forms of life but an understanding of their relation to other forms of life. With the story worded as it is no child can help but get the name of the birds with a little assistance.

Squirrel Tracks

From The Cornell Rural School Leaflet for January 1920

For the older children a "Life-History Chart" is given which gives all of the essential information dealing with the home life and habits of sixteen small winter animals of New York State. This is accompanied by a simple key to all the smaller mammals of the state. In some cases, information is lacking to science concerning the life histories of some fairly common mammals. In the chart this is indicated in the hope that some observers may be able to offer really valuable information. The idea of using the key (which is in common English) and the "Life-History Chart" was to make information available concerning any mammal which might be found rather than to confine the scope of the *Leaflet* to some one animal which might not be found. This will avoid the danger of having to have a lesson on, let's say, the gray-squirrel which may be uncommon while the school wood-box is the home of a family of deermice.

A boy playing at making squirrel tracks

From The Cornell Rural School Leaflet

Once the children have gained an interest in the life history of the common mammals of the community it is not difficult to show the necessity of intelligent use of good that can be gained from them. The game laws so often misunderstood are the natural out growth of the observations of those who had the vision to see that unless protected these animals would not be able to survive the conditions imposed upon them by the increasing population of human beings. One naturally expects to find then the subject matter of the January *Leaflet* terminating in a brief of the New York State Game Laws dealing with fur-bearing animals. There is a reason why each of these laws exists or there should be. If children understand these reasons they will champion rather than

attempt to defeat the purpose of these laws. Some of these children will some day make other laws and the only thing this generation can ask of them is that they keep in mind that all law should consider what is the just thing for all concerned. No fear need arise as to the future of our national resources if we can educate a generation which will see that the privileges we gain from the possession of these resources should not be abused. If the legislators in Iowa who attempted to make it permissable to kill quail, (the farmer's best friend), and refused to consider a law making it possible to kill stray cats, (surely not a friend of the farmer), had learned concerning the life history of a quail in their youth, they never would have taken the selfish stand some of them did. Sometimes it seems to be the perversity of human nature to abuse our friends and help our enemies. It is hoped that Nature-Study as taught through the *Cornell Rural School Leaflet* will at least help us to recognize our friends and enemies when we see them.

Another new feature of the January *Leaflet* which is strictly seasonal is a section known as "Fifty Interesting Things to Look For in January, February and March." The topics considered under this heading are chosen from the fields of botany, zoology, meteorology, entomology and ecology. Each topic is treated in a more or less uniform manner. First a description of the creature or phenomenon as it appears in the field is given. This is followed by the name of the form together with a question which requires additional observation. In order that the child be given credit for having observed what is asked for, he should be required to answer the questions based on the additional observation. This does away with the objection raised by some teachers that children will report having seen a thing when they really haven't. They do not mean to falsify but their imagination runs away with them. The questions requiring observation do away with this undesirable possibility.

An example of the manner in which one of these topics is treated is shown as follows: "Watch for a little gray bird which shows two white tail feathers when it flies. It is the junco. Does it hop or walk? What color is its breast? What color is its bill?" One of the main purposes of this section is to direct observations of children so that the material in subsequent numbers of the *Leaflet* may fall at least on partially prepared ground.

The College of Agriculture hopes to be able to learn something of the success of the policy followed in these *Leaflets* by an exhibit held at its annual Farmers' Week. Each number of the *Leaflet* closes with a list of the work based upon that number which may be entered at the exhibit. Each school may make but one entry in each of the classes outlined and as a result this should encourage school fairs to decide which of the material should be sent to the Farmers' Week Exhibit. Exhibits at the State Fair are also based upon this list. A policy of this nature where the list of exhibits is changed from year to year should do away with the objectionable practice of entering certain exhibits year after year. Under this newer system the fair should show what has been done in the last year only. As a result the tendency to rest on one's oars should be lessened and the spirit of work enlivened.

The March *Leaflet* dealing with the resources associated with the fresh waters of the state follows much the same policy as that outlined for the January number. Professor James G. Needham contributes an article descriptive of the lakes and other waterways of the state and with the relation of the water system to the distribution of population, to the history of the state and to their economic significance. He also discusses the necessity of a pure water supply and offers a striking comparison between a child drinking directly from a spring and the elaborate system necessary to furnish New York City with pure water.

The story for children is built about the life history of a brook trout. This is written after the manner of an autobiography and introduces the more conspicuous forms of aquatic life with which a trout might be associated.

Instead of the landscape which appears in the January number a "waterscape" now appears. This is also a cut-out series and is accompanied by a page of outline drawings of fish. The various types of aquatic environment are numbered and the fish are numbered in accordance with the type with which they are most commonly associated. By this method the children may learn in what type of water formation each species should be found. An additional value to the "waterscape" arises from the fact that instead of making the vegetation merely artistic, definite species are selected and so placed that they may be used to assist in identifying common marsh and aquatic plants. The value to be derived from this feature alone should justify this section of the *Leaflet*.

The "Life-history Chart" which in the January number dealt with fur-bearing mammals in the March number deals with fish. Each species of fish which is mentioned in the New York State Game Laws has the essential facts concerning its life history recorded in this chart. Accompanying this is a brief of the fish laws of the state and a figure which shows the relation between the breeding season and the open season of various species.

The seasonal section of fifty interesting things to look for is present with appropriate material for April, May and June. It is believed that this is sufficient to care for the interest in general phenomena which are not directly associated with the main topic of the *Leaflet*.

Let us for a moment summarize the whole situation. Opposition to conservation of natural resources arises largely from ignorance and greed. If necessary, greed may be enlisted in favor of conservation because all gain is dependent in the long run upon an intelligent use of available resources. Without this intelligence chaos and failure must result. Balance is the key word to conservation and for that matter to society as well. We are all dependent upon nature and nature is a wheel many of whose spokes are worm-eaten by thoughtless acts of human beings, like ourselves. As a result of this unevenness life does not move as harmoniously as it might were the proper balance preserved. The *Cornell Rural School Leaflet* hopes to try to restore these broken spokes in the wheel of nature. If this cannot be done it may at least show where the weak points are and help make re-enforcements where possible. The passage of laws and the appropriation of sums by legislatures will not ensure success. Neither will speeches at meetings of learned societies or articles in technical journals. These all have their part but real results are bound to show when we can educate the every day man and woman to see the justice of the movement. People are willing to champion something about which they know. And *The Cornell Rural School Leaflet* hopes by the method just outlined to at least give the coming generation the opportunity of finding out the facts that underlie respect for natural and civic laws.

Nature Stories as Nature-Study Material

Lewis M. Dougan

Public School Principal, St. Louis, Mo.

A group of us recently helped to take our local Christmas bird census. We were glad to find so many tufted titmice and were especially pleased by their cheery behavior on a somewhat gray and gloomy day; but we were perplexed by the apparent blue color of their backs. One suggested that we must be mistaking bluebirds for titmice, but that suggestion was rejected because the bluebird has no crest. Another, that our trouble might be due to a bias of individual vision. No, all saw the blue. Had we read the description wrong? No, Chapman clearly states it: "Back ashy-gray." Was it an effect of certain conditions of the atmosphere acting on the light? Perhaps; but it appeared distinctly blue in all lights as far as observed. In whatever way the matter may be settled, our experience was fairly typical of that of Nature students in the field. We went afield with a purpose. We observed. We discovered a problem. Hypothetical explanations occurred to us. We observed further. We rejected all suggestions, but presently we shall come upon the right solution which will stand the testing.

How did we come by this method? Most of us agreed that it came largely thru imitating some wise field leader whose enthusiasm we had caught. Partly of course, by the use of books of reference as helps in the solution of some problem which had arisen in the field. Partly, perhaps, from nature stories. Note the *perhaps*.

In contrast with the training we received, the children of our large cities, removed from wild nature are largely dependent on the nature stories now so much exploited as supplementary reading. How shall this story stuff serve our purpose? Shall we use it merely as reading matter largely for its emotional value? Hardly so. It ought to be enjoyed but it ought to promote systematic observation and straight thinking outdoors.

Let me briefly analyze a typically useful specimen—a well-known fox story. In this is clear accurate description couched in good diction calculated to strengthen rather than blur the image derived from Nature; and it has plot. By plot in literature we mean somewhat the same as the project problem of recent pedagogy

and in working out the plot, our author, it seems to me, exemplifies the method of thinking we are trying to teach. He tells in order:

1. How Reynard was trapped.
   a. How he was attracted to the bait.
   b. What precautions he took to avoid danger.
   c. How he was finally deceived.

2. How he escaped from the trap.
   a. His first reaction to the trap.
   b. How he tried to shake it off.
   c. How he bit off his foot.

Either of these subordinate phases of the general plot illustrates an organization of incidents and a method of mental activity very suggestive of that used by our group of bird students, a method most young pupils greatly need.

The proper use of nature fiction both prose and poetry, that which makes no false pretenses as well as that which Mr. Roosevelt condemned as Nature faking and Mr. Ruskin berated for its pathetic fallacy, I cannot here discuss. Neither the rambling, discursive comment on Nature. I simply point out one sort of thing we can make excellent use of when we can get it. We can treat it analytically as problem material focussing the interest on the problem as we do in the field. We may not claim that any books used indoors exclusively will impel pupils to go afield, but they may tend that way in the hands of a teacher who tends that way herself. In such a case their outcome whatever is is will probably be good.

Coming Issues of the Nature-Study Review

March 1920. The School Garden Number. Edited by Susan Sipe Albertis, Director of School Gardens, Washington, D. C.

April 1920. The Bird Study Number containing a detailed outline of Bird Study from the Kindergarten throughout the Grades. Extra copies should be ordered early.

Geography and Life

Anna Botsford Comstock
Assistant Professor in Nature-Study, Cornell University

Life and Geography have long been partners. The interests of the two seem sometimes to have been diverse, and yet life is so adaptive that in many cases these naturally divergent interests have become unified

A very important phase of biological work at present consists of studying the many ways through which animals and plants have unified their interests with geographic conditions; this phase we know as ecology.

The teachers of geography have perhaps been too occupied with teaching geographic facts. They have dealt too exclusively with "*what is*,"—as for instance the desert *is* a place of sand and heat and drought and upon it there *is* scant vegetation or none at all. We have been content with such bald statements as these but they satisfy us no longer. We are now coming over to the point of teaching that behind every "is" there is a "because" and in very many instances it is a geographical "because." So now we say the desert is there *because* mountains shut off the moisture from the sea and therefore there is no rainfall and therefore there are no rivers. The winds, *because* of certain configuration of land or sea are severe and dry and are never the bearers of rain clouds. Therefore, in these wastes there is little vegetation; only such animals and plants exist there as can endure heat and thirst and a scanty food supply.

It is slowly dawning upon the minds of those of us who are teaching Nature-Study subjects that there are just as many and just as cogent geographical "becauses" behind every "is" in the school yard as there are in the desert or the swamp or a glacier-hemmed bit of Greenland. And it is through understanding the *because* which is nearest him that the child may understand the great *because* that lies behind the most stupendous geographic facts in the world.

The child is the center of our pedagogical circle and from each bit of his own experience a radius may be drawn to the confines of the universe and right here is where geography is helped by Nature-Study because the latter leads inevitably to the intelligent understanding on the part of a child of his own environment. Let us consider for a moment how we may begin extending these radii so

that the child from his own experience may be able to see truly beyond his own horizon wherever the radii may lead. To illustrate this let us suppose that near our school there is a quiet river, pond or lake upon which float the leaves and flowers of the water lily. Let us carefully study this plant and its adaptations. We find its root-stock is buried in mud where it serves as an anchor and we find that upon the root-stock there are a few root hairs. The reason for this is easy to see; the food and moisture are so immediately at hand that root hairs do not need to be sent out into the soil in search of them. We examine the leaf and find that it is essentially a boat and is made to float. It may even have its margins upturned to insure its floating and the lower surface is leathery and waterproof; and the stomata, ordinarily more numerous on the lower sides of leaves, are here entirely on the upper surface, added evidence that this leaf is a boat; however, it functions perfectly as a leaf as well. We find the leaf anchored to the root-stock by a long soft, flexible stem which offers no resistance to the movement of the water but holds the leaf-boat fast and at the same time carries food and sap as do other stems. The flower of the water lily is also a boat with such a gradual change from the outside sepals to the petals that every crevice is calked with green waterproofing; each lily boat is anchored by its flexible stem, moreover, each lily opens its overflowing anthers to the sunshine only during the period when the insects which fly over the quiet waters are active and may thus cross-pollinate these blossoms. But this flexible stem seems after all to be a stem of purpose and pulls down below the surface of the water the ripening fruit capsule; and the seeds when liberated show that they are to the water born for they have a coat that acts as a life-preserver so that they rise to the surface and float off to favorable locations for settling.

To understand how fully our water lily has accepted and made the most of its watery environment, let us imagine for a moment how it would act if it were planted upon the dry bank above its pond. What could such a root-stock do with so few root hairs to provide it with moisture and soil food? What would such heavy, thick, leathery leaves do if they depended upon their soft flexible stems to hold them out to the sunshine? How could the heavy white blossom be held aloft while it opened to the world its beauty and fragrance if it depended only upon its rubber-like stem instead of the gentle waters for support?

However, not in all waters do these lilies grow; their adaptations are for a certain limited condition; the waters must be still and not too deep, and there must be a silt bottom. After understanding the adaptations of this beautiful plant to its environment the pupil has a radius of knowledge which should take him to the Nile, that great river on whose quiet expanses, away from its swift current, grows the lotus which inspired the ancient Egyptians to make beautiful the sculptured columns of their temples. Another radius would reach to the wide Amazon in whose shallower side waters float the magnificent *Victoria regia*, the water lily whose leaf is so huge a boat that it may support the weight of a man. In each case the child will see a true picture of quiet waters, not too deep and with muddy bottom. Thus in a thousand ways can Nature-Study guide and train the child's geographical imagination, so that it is a safe bridge across which he may safely pass from the known to the unknown. Through studying the self-sufficient mullein in the sheep pasture or the moisture conserving purslane in the gardens, he may understand the devices of plants that endure the drought of the desert or the hardships of arctic conditions.

It is only a step farther for the child to comprehend how entirely animal life is ultimately dependent upon plant life. The fox may feed upon the rabbit but the rabbit must feed upon the clover. Friend Downy finds his food in the beetle larvæ which in turn feed upon the woody tissues of the tree. The lion feeds upon the antelope and zebra and these in turn feed upon vegetation.

Consider for a moment the possibilities that lie in the study of a shiner or pumpkin-seed which the boy who goes fishing may bring to the school aquarium. Observe its adaptations for successful life in the water; the shape of its body and its covering of polished scales enable it to move through a medium so much denser than air with the least possible friction; the way its uses its fins and tail in swimming, how it breathes the air mixed with the water by means of its gills, how it is adapted to get its food and how its coloring above and below and its swift movements aid it in escaping from enemies. Add to this by a study of the scaleless barbelled bullhead and the pocket-mouthed sucker and the pupil is well fitted to understand something of the teeming life in the ocean, and the much read sea stories of sharks and whales will have real significance to him.

The common woodchuck, the more or less understood companion of every country boy, is a fine type of a burrowing animal. His feet are adapted for digging, his cheek-pouches for carrying food; his ears may be closed at will to keep out the soil when it is digging; his tail is short and unobtrusive in the burrow but is a bulwark to prop him up on his haunches when he lifts up to make observations on the approach of danger. When all these characteristics and many others have been observed and understood then the pupil of the East may have a practical knowledge of the prairie-dog of the arid plains and the gophers of the Middle West and the Rocky Mts. and Sierras.

Few of our pupils are fortunate enough to be able to study that remarkable animal, the beaver, through personal observation. But, on and around almost all our streams, the muskrat still flourishes; he has feet for digging that are also webbed for swimming, his fore-feet having fingers and thumb for holding food; in summer he may live in a burrow in the bank but in winter he may build himself a domed house of reeds, sticks, and mud in some pond,—a house high and dry above water but with an entrance below so that he can get to the pond bottom to search for roots of marsh plants; his tail is scaly and flattened to aid him in swimming and in giving warning signals when an enemy appears by slapping the water; he has fine, soft, waterproof fur and he is in many ways a miniature beaver. A study of him should lead the boy to those parts of our country where the beaver still builds his dams and to a thorough comprehension of that remarkable animal which has taken such a prominent part in changing the geography of our land; I remember that our own ancestral farm covered fifty acres of "beaver meadows," very rich land when drained.

A study of our weasel or our varying hare, possible to any boy interested in trapping or hunting, brings knowledge of the advantages to an animal to have a winter coat of white and leads directly to the consideration of the polar bear, the arctic fox and other arctic life. The study of our dog, whatever his breed, leads out to the study of wolves, coyotes and foxes. The study of puss builds a radius that reaches to the habits of lions, tigers, leopards, and panthers.

The Geography teacher has a mine of riches in the circus menagerie and the zoo. With selected readings from the books of great naturalists from Wallace and Darwin to Roosevelt and

Chaillu there may be built up a picture in the mind of the pupil that will serve as a true background for the caged animal he gazes at with such fascination, a background that would be the truest possible lesson in geography. Moreover, he should know where on the map of the world this picture belongs. He should also know the natural food of the animal, how he gets it, whether he hunts by day or by night, what his enemies are and how he escapes them, whether he lives alone, in pairs, or in flocks or herds, how he protects his family young, what are his relations with the native inhabitants of the region and what sort of people these inhabitants are.

The birds should be geographic messengers to every child because their adaptations to environment are so many, so fundamental and interesting. Through the study of our domestic ducks and geese we should build out a radius to the water birds of the seas and oceans of the world; and by a study of the useful hen to all the jungle fowl, the pheasants and grouse of the forests of the world; and by observing any of our common herons to all the storks that stretch their necks through the literature and history of Europe, and thus on ad infinitem.

The birds, best of all creatures, have learned to cope with and use geography. They have developed their great powers of flight so that they may vary geographical conditions to suit the varying seasons of the year. The whole scheme and reason for bird migration is at bottom geographical; moreover they lay out their migration routes by following mountain chains, river valleys and coast lines. Let us suppose that the boy whose music loving soul has this summer been thrilled with the bubbling melody of the bobolink should trace as nearly as possible the fall and winter journeyings of this same individual bird and map his migration route and winter dwelling place; would not that fix in his mind more clearly our own southern coast, the West India Islands, the north coast of South America, the Amazon and central Brazil, Bolivia and Paragua. Let him also write an imaginary story, based upon the numerous books of travel in South America, of this bobolink's experiences in these strange forests and wildernesses. This story will be vital geography for that boy because it was written about his friend, the bobolink, and his experiences from the time he left the hill meadow in August or September until he returned to it the next April.

If we thus teach the child to reach out into the world and build up pictures of it thru his own knowledge and experience we shall have accomplished for him a very great thing. We shall have impressed upon him that every step he takes he is putting his little foot down in the midst of geography and that whatever else he leaves behind him he can never, living on this earth, get away from geography. No longer will the world be mapped for him with red, yellow and green countries. No longer will rivers be mere wriggling black lines on the map, no longer will lakes be merely blue irregular spaces and no longer will mountains look to him like caterpillars crawling over his map. A river will mean to him a stream with all the life which it carries in its current or irrigates along its banks. A mountain will mean towering heights covered with forests or perhaps with snowfields above them and he will comprehend more or less correctly the life of the world thru his own little sectional study of life and he will find a new interest in the study of his own environment when he realizes that this whole great world is typified in his own brook, pond, forest or pasture.

Cascadilla

William Prindle Alexander

Time was Oh! stream when thou didst flow
Wildly through thy valley wending,
Emerald with silver blending
In forest pools of long ago.
Thy song alone remains the same
Romantic rippling of thy name,
Cascadilla.

Thou the birch canoe hast borne
Where thy waters lave the sedges,
And the eagle sought the ledges
In the gorge that thou hast worn;
Gone the tribes that thou hast known,
They like wafted mist, have flown,
Cascadilla.

Gone Cayuga brave and squaw
That planted maize thy course along,
Gone the Council, dance and song,
Feathered gear and panther claw,
Gone the hundred fires aglow,
That reddened thy nocturnal flow.
Cascadilla.

Silvery o'er thy bed of shale
Send thy spring-borne burden pouring

Photo by Verne Morton

Still as in the vanished days
All thy glades with joy are ringing
And a vibrant choir is singing
Springtime's sweetest roundelays,
When the shadbush sheds its snow
Of vernal bloom, on thee below,
Cascadilla.

Still the alder spreads it shade
Where the busy beaver felling
Tree and sapling reared its dwelling,
And a dam across thee made,
Still the rushes in the fen
Grow beside thee, now as then,
Cascadilla.

I have sought the upland mead,
Where thy course is unpretending,
Sought and found a joy unending
Roaming where they waters lead,
On through ever changing leas,
Into newer Arcadies,
Cascadilla.

Goldenrod and jewelweed
Flank thee, and the evening primrose
Blooms, and many a drooping limb grows
Sheltering over sedge and reed;
Rock with softest moss veneer,
Part thy rushing waters clear,
Cascadilla

Or where banks imperious raise
Tree bedecked, in ramparts stately
I have stood and marvelled greatly,
Gazing on thy cliffs ablaze,
Autumn's myriad beauty, spread,
Inverted on thy mirrored bed,
Cascadilla.

Silvery o'er thy bed of shale
Send thy spring-borne burden pouring,
God hath laid thine ancient flooring
Truly in a chosen vale;
Eager yet to come and go,
Thou sweet stream, forever flow,
Cascadilla!

THE NATURE-STUDY REVIEW

DEVOTED PRIMARILY TO ALL SCIENTIFIC STUDIES OF NATURE IN ELEMENTARY SCHOOLS

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Editorial

Not enough has been said of the spiritual value of meetings of scientific societies. The incentive to greater work and the mental stimulation that comes from seeing and hearing of the work of others in the same field are well recognized and primarily form the reasons for the establishment of such societies. But there is another side even more important and whoever misses it misses the best of it, and that is the sympathetic side, the bond which unites the experiences of two people or of many; the bond that comes from the consciousness that here we are in a company with others who are travelling our own road, knowing the obstacles under foot and comprehending the wide outlook above and on either side. Here are those who can grasp our hand in a fellowship which is true companionship, those who can suggest helps to overcome and plans for avoidance of the difficulties which beset us.

Never have we felt this to be more true than at the St. Louis meeting of the Nature-Study Society. There were many strangers present whose names we did not know and whose friendly faces were new to us, but we knew they were our fellow travellers over the Nature-Study road and their presence wrought for courage. There were also present those whom we had seen and known before and those of whom we had heard and not seen and their presence gave spiritual uplift. There is surely a subtle freemasonry among Nature-lovers that establishes companionship and warms the heart.

The 14th Meeting of the Nature-Study Society of America

On the morning of December 30th there came to Room 216 of the beautiful new Soldan High School of St. Louis a goodly number of the members of the Society. However, because we needed to cross the city and reach the city club as nearly noon as possible, the Society was not called to order for a morning session. A luncheon for the members of the Society and for the members of the city club had been planned for the special purpose of listening to an address by our former president, Professor Liberty Hyde Bailey. The luncheon was a very pleasant affair and every table in the large room was filled. Professor Bailey gave an inspiring talk on "What is Democracy," in which he pictured Nature's way of dealing with the "Red Forces," most suggestive of the wisest methods of solving some of our present social problems.

At 2:30 we returned to the Soldan High School and the meeting was called to order with Dr. Eliot R. Downing in the chair since Dr. Schmucker was detained at home by the meeting of the Penn. State Teachers' Association. The Secretary read Dr. Schmucker's address as retiring president. Next on the program was the address by E. Laurence Palmer on the work of the *Cornell Rural School Leaflet*, also read by the Secretary and which was most cordially received. This was followed by "The Relation of Nature-Study to the Work of Boys and Girls' Clubs" by Miss Theodosia Hadley, an address which we hope every reader of THE REVIEW will read carefully.

After Miss Hadley's address there was a business meeting at which the following officers were elected: President: J. A. Drushel, (Mo.) Vice-Presidents: S. C. Schmucker, (Penna.), W. G. Vinal, (R. I.), G. H. Trafton, (Minn.), J. G. Needham, (N. Y.), L. H. Bailey, (N. Y.); Directors, 3 years: J. M. Dougan, (Mo.), C. H. Robison, (N. J.), C. L. Edwards, (Calif.), J. M. Stover, (Tenn.), E. R. Downing, (Ill.); Directors, 2 years: J. A. Dearness, (Ont.), L. H. DeWolfe, (N. S.), Susan Sipe Albertis, (D. C.), H. S. Brode, (Wash.), E. L. Palmer, (N. Y.).

With Professor Drushel in the chair the program was continued. Dr. Downing gave the results of some simple tests in the grades showing the teachers clearly how to ascertain how much their pupils retain of the facts learned in their Nature-Study work. This was

followed by a talk by Professor Lewis M. Dougan, giving valuable suggestions as to supplementary reading. The next on the program was the editor of THE REVIEW with her pet theories of the ways that Nature-Study and Geography should be partners in the school room as well as in the world. Then came a talk by Professor B. G. Shackelford on the relation of Nature-Study to elementary science in which he stated clearly his belief that Nature-Study should have for its aim making the child love Nature rather than the mastering of scientific facts. After this came a very delightful talk by James Newton Baskett who is the veteran leader in the right way to study birds and fishes. It was one of the greatest privileges of the meeting to hear Dr. Baskett speak. The very profitable meeting ended at five o'clock with the report on the fortunes of THE NATURE-STUDY REVIEW by the Editor. There were about fifty people present including Professor and Mrs. T. D. Cockerell of Colorado College, and Mr. Johnson of the Colorado Normal, and even Professor Vernon L. Kellogg, known so widely through his work in Belgium with Mr. Hoover and as author of "Headquarters Nights" gave us a little of his valuable time.

ANNA BOTSFORD COMSTOCK,
Secretary.

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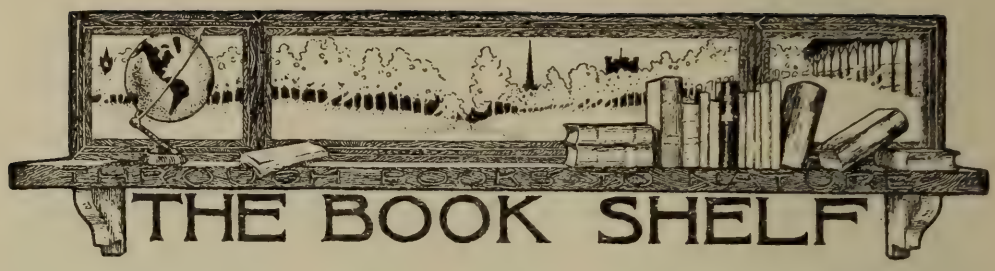

The Trail Book, Mary Austin, 304 pp., illustrated, Houghton Mifflin Co.

The plan of the Trail Book is charming. Two children whose father was the night engineer in a museum have wonderful experiences. The boy, Oliver, is very imaginative and the girl, Dorcas Jane, is very matter of fact, but they are both equally interested in the experience. Oliver believes that the stuffed animals in the museum "came alive at night and had larks of their own." The children managed to spend a part of the night in the musuem "tucked into one of the window benches between the cases, the children seemed to swing into another world where almost anything might happen." So they sat and waited. All at once the bull Buffalo shook himself. "Wake! Wake! said the Bull Buffalo, with a roll to it, as though the word had been shouted in a deep voice down an empty barrel. He shook the dust out of his mane and stamped his fore-foot to set the herd in motion. There were thousands of them feeding as far as the eye could reach, across the prairie, yearlings and cows with their calves of that season, and here and there a bull, tossing his heavy head and sending up light puffs of dust under the pawings of his hoof as he took up the leader's signal.

"Wake! Wa—ake!"

It rolled along the ground like thunder. At the sound the herds gathered themselves from the prairie, they turned back from the licks, they rose up plop from the wallows, trotting singly in the trails that rayed out to every part of the pastures and led up toward the high ridges."

Thus the Buffalo came alive and then told his story giving a description of the Buffalo country which took in the cliff dwellers on the one hand and the mound builders of the Mississippi valley on the other. Then the mastodon takes up the tale with his story of the trail to the sea. Then the coyote takes up the story of the Country of the Dry Washes which lies between the Rockies and the Sierra Nevadas towards the South. Then follows the story of how the corn came and many other interesting stories. The idea underlying all these stories is how the original trails across our country were made. As the author says in the Appendix, "All the main travelled roads in the United States began as animal or Indian trails. There is no map that shows these roads as they originally were, but the changes are not so many as you might think. Railways have tunneled under passes where the Buffalo went over, hills have been cut away and swamps filled in, but the general direction and in many places the actual grades covered by the great continental highways remain the same."

The stories are delightful and the book is superbly illustrated by Milo Winter. Mary Austin's years of experience in the great South West and

her acquaintance with the various tribes of Indians have given her, with her love of nature and her keen sympathetic insight, a great store of riches which she has used lavishly in The Trail Book.

Maeterlinck's Dogs by Georgette Leblanc-Maeterlinck, 175 pg., illustrated, Dodd, Mead Co.

Whoever loves dogs should have this volume in his library. Madame Maeterlinck knew how to describe a dog's personality in a most interesting manner, and her interpretation of dogs' thoughts, affections, and emotions are as charming as they are original. The volume includes stories of Louis the Debonnaire, Raymond the Clown, Achille the Misunderstood, Gaston the Highwayman and Delphine, Golaud the Superdog, and Jules the Sponger. Each of these is a study in dog psychology and history. Here is a description of the relation of Golaud to his master: "Here, on the morrow of his arrival, the new dog, christened Golaud, was to undergo the great and supreme ordeal, which consists in behaving well while the master is at work.

Do not imagine that this is an easy thing for a dog to do! He must not snore too loudly, nor scratch himself too vigorously, nor move about too much. Golaud passed the ordeal magnificently, but in a manner peculiar to himself. Absorbed in solemn contemplation, he seemed utterly oblivious to sleep, fleas, or the chances of amusement. Seated beside his master, he gazed at him as he wrote, seeking in vain for the explanation of an action which he had never before observed and of which he failed to see the attraction. which he had never before observed and of which he failed to see the attraction."

Here is an interpretation of Golaud's opinion of himself:

"Maeterlinck is my god; and his shadow is my country. I have no family, no religion, no principles. My conscience is enough for me. I have seen everything and understood everything. I have not wasted my time, as human beings do, in seeking the meaning of life. I discovered it at my birth: it is obedience. I despise money, which human beings run after, and glory, which turns their brains. I have judged society and its values, its ladder which you must descend so that you may seem to climb and all its ridiculous train of vanities. I possess all the virtues. I am generous and brave; small animals I protect; all those which dare to be bigger than myself I attack. I love all human beings; I have learned that the habit does not make the monk; and I make a profession of silence. I am modest; my master cannot work without me, but I lay no claim to recognition as his collaborator."

The volume is graphically illustrated by the author who is as clever in depicting dogs with her pencil and brush as with her pen.

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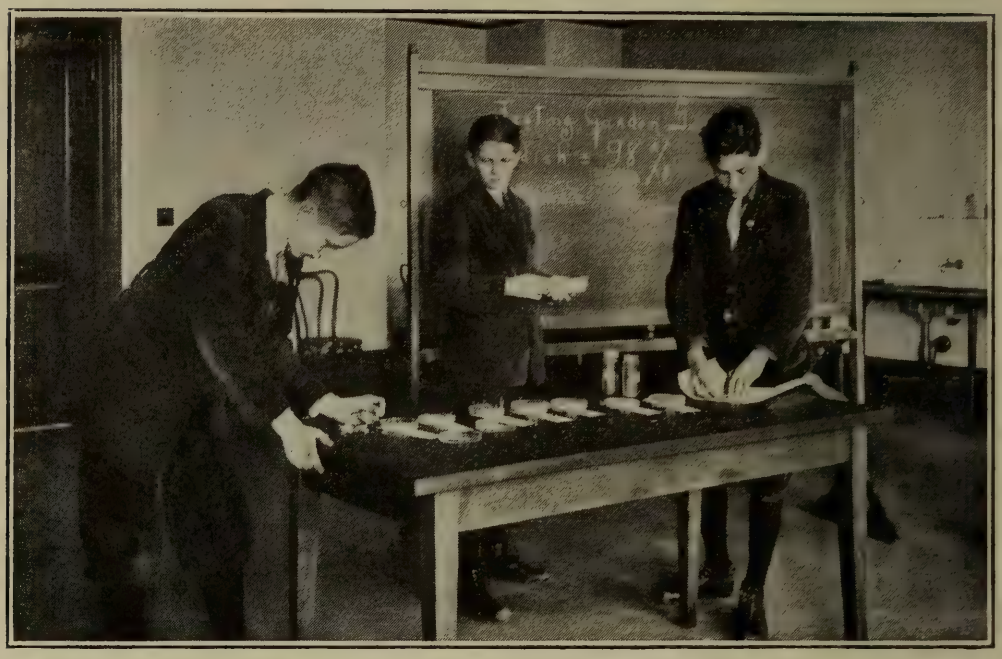

The test of garden seeds by junior gardeners at the Brooklyn Botanic Gardens

TABLE OF CONTENTS

Efficiency Aids to Garden Work. ELLEN EDDY SHAW - - - 89
Gardening as a Part of City Education. JOHN L. RANDALL - - 95
Wishes. BERNICE RANDALL - - - - - - - - 97
The Garden Health Drive—A Play. ALBERTA WALKER - - 98
Costumes and Scenery for the Garden Health Drive. DOROTHY KALB 101
Bits of School Garden History - - - - - - 104
Are Exhibits and Prizes of Value? A. N. ROBERTS - - - 105
A Suggestion for Teaching Bird Protection. NELLIE HARRINGTON - 109
A Bagworm Drive. ANNA PARFITT BARTON - - - - 109
Some Enemies of the Garden. GLENN W. HERRICK- - - - 113
Editorial - - - - - - - - - - 123
Reports from Garden Supervisors
Waltham, Mass.; Louisville, Ky.; Washington, D. C.; Grand Rapids, Mich.; Richmond, Va.; Philadelphia, Pa. - - - 124
The Children's Corner - - - - - - - - 130

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THE
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Efficiency Aids to Garden Work

ELLEN EDDY SHAW

Curator Elementary Instruction, Brooklyn Botanic Gardens

The smooth running of a garden for boys and girls depends at least fifty percent. upon what one might call "efficiency aids." I use this term merely because it is a popular word of the moment, otherwise one might change the title of this article to "Helps in Children's Garden Work" or "Aids in Gardening."

Before any child enters the garden, whether it be a school garden, home garden, or community garden, he should have had certain lessons which familiarize him with the materials he is to use and the method employed in the use of such materials. For example, and I shall use my examples from my work with children at the Brooklyn Botanic Garden, six weeks before the garden is actually planted, the boys and girls come once a week to receive definite lessons in gardening. This is the first step toward preparing them for the great event when the garden really opens. Visit us on a Saturday morning, or after school in the middle of February, and you will see 20 or 30 boys and girls seated in one of the classrooms in the form of a kindergarten circle. The attention of this class is riveted upon the floor, for upon the floor is drawn out in chalk a rectangle 8′ x 10′, a space the size of the beginner's garden plot. A lesson is being given on measuring and marking with chalk each drill, and laying down the seeds in exactly the way they are to be sprinkled or spaced in the garden plot. One gets no feeling of depth in this sort of planting, but each boy and each girl knows exactly how that plot is to be marked off, the number of inches between rows, and how his seeds will look when lying properly in the soil bed later on. Notes are taken, and later at home each child draws his plan, plotting it out to scale.

Two hundred and twenty boys and girls gathered in our auditorium last April for the first morning's work. Two hundred

represented the boys and girls of what we call our "large garden." This is a garden of beginners, second year people, and occasionally a few third year people. The plots are all 8′ x 10′. These are all planted alike, but never remain the same after the first row of radishes has matured and comes out of the bed. The other 20 boys and girls in the auditorium are high school people and grammar school children who have been in this garden three and four years. These are called "junior gardeners." They have plots 10′ x 20′ on a separate piece of land. They make out their own plans, start their own seedlings in the greenhouses, and are supposed to do almost independent work. Two hours a week through the spring and summer these boys and girls have what is called a conference in which those things that have bothered them are taken up, and during this time one of the teachers will go to the gardens with them and visit their plots to find out what their problems really are.

These junior helpers worked in the garden thorughout this last summer each one teaching from three to six children, according to his ability. Perhaps four out of the 20 became such real helpful junior gardeners that by August they could handle eight to ten children apiece. The little groups of junior supervised children were scattered through the garden rather than blocked in one spot. This is, I believe, the very best arrangement because the teaching by these older boys and girls many times will be weaker than that of the regular teachers, and one sees the results in the plots. This is not always true. In some cases the boys and girls get fully as good results as do the older teachers.

Going back again to the first morning in the auditorium, the boys and girls were called off by numbers in groups of ten. Of course, long before this they have known the number of their plots, have looked at a large chart, and such charts should be made by the upper boys and girls in the garden, and know their places in the garden. Ten boys and girls are to be taught by a teacher. In the special work of mine at the Botanic Garden we have a training school for garden teachers and this work with the boys and girls is their regular practice work. It happened this past year that we had a very small group of practice teachers so that we drew upon our graduates of other years. What would one do in running a community garden or a school garden on this plan? Just two things could cover this case. First, the preparation of junior

gardeners even before such gardeners had had enough practice. This could be done. The second solution would be to train some volunteer adults or teachers for just this work of starting the garden.

The teachers were all there too, that first morning, with baskets filled with bottles of seeds they were to use. Each teacher had assigned to her a helper from among the boys and girls to assist in her group, because that morning junior helpers did not teach but assisted the regular teachers—a sort of trying out of their ability.

The gardens had been marked out prior to this by the practice class, or if this were a school garden, by the upper grade boys and girls. Upon each garden bed was placed the stakes and line, that is, two stakes with a line just the length of the garden row to be planted, or ten feet in length. The line is masons' cord which will last years. This might be a part of an individual child's equipment in a private school. Pot labels as markers for each garden row—exactly the right number of them—were also placed upon the garden bed. Besides this, a stick nine inches in length was found to be used in opening up the drills and for a measuring stick. Three inch and six inch spaces were marked off on this stick. This graduated stick plus the markers which were six inches in length, represented the measuring rods for the children's use. The junior gardeners had placed these sticks upon the plots early that morning. As the boys and girls and their teachers marched down into the garden they saw a number of older boys standing in the garden paths with baskets or boxes in their hands. These baskets and boxes were filled with onion sets and the boys were to go about giving to each teacher as she needed, the onion sets. It is a very easy matter to have the older boys figure out exactly how many will be needed. In our rows we placed them just six inches apart. Had the onion sets been a little cheaper last year we would have placed them four inches apart in the rows. Other boys carried extra bottles of seeds through the garden so if a tecaher ran out of seeds or labels because of any mistake she would have no trouble in immediately having more presented to her. Every teacher had in her basket a stiff piece of pasteboard upon which was pasted a plan of the garden plot and also directions for planting which had been given previously in the indoor lessons to the boys and girls. I have found in my work that the adults need as many aids as the children do. The mere fact that no teacher has had to

rush around the garden to bring an extra cord and line, to look out for the onion sets, or to find more seeds, takes away that feeling of confusion which I have felt so many times myself and have observed in the work of other people. We ought all of us to strive to minimize confusion, and these few simple things which we have done, and which others may have planned also, minimize greatly the possibilities of trouble.

After the gardens had been planted the boys and girls were divided into sections, 50 in a section to come at certain stated times. In these groups of 50 there were children who had been handed over to the junior gardeners so that each regular teacher had only about 25 boys and girls to look out for, although of course, the junior gardeners always had to have some little attention.

One might almost call such a piece of work for the older boys and girls a piece of project work, for bound up with it are many possibilities for these boys and girls to use their own initiative. Their methods of handling other children improved greatly as the summer went on. This in itself is worth while for those older people, and I believe was also worth while for the younger boys and girls. More and more I begin to feel that children's gardening should be for children and not a means of effectively displaying the work and plan of adults.

Each young gardener now goes on at his own rate of speed, when he comes to the garden once a week before school closes, or two or three times a week after school session is over, he finds on the bulletin board his directions for his day's work. He knows exactly where his own tools are in the toolhouse and goes and gets them. He then passes out to his work. He comes back to wash his vegetables and to hand in his report. The attendance and the crop report is kept by the boys and girls. Each day there is a host or hostess who sits in the tool room and takes the crop record. The work of the host or hostess is to see that the little living room is kept in order, guests welcomed if they happen to come, and the boys and girls kept up to time. By that we expect them to keep their hats off in the house, to walk decently and properly as they would in their own homes, and to come in with clean boots, but we cannot always insist on tidy hands. Out in the tool room is a sheet of paper laid upon the table, and a pencil. Each person registers himself by putting a mark after his plot number. A monthly sheet is made out with all the numbers of the plots upon it. Number 1 goes in and puts a check after his name; Number 2 may be

At work—Here and there Junior Gardeners are seen assisting

absent; Number 3 checks his attendance, and so on. We have found this a good method because it throws the work upon the children. This attendance later on is put into a book by the teacher or by an older boy or girl. The book must be neat as our work must be properly done. After the lad has registered, you may see him walk up to a German helmet and drop a few pennies into it. This is the way we take of raising money for our French orphan.

All kinds of little classes for study may be formed out of a garden group. Vacation possibilities are posted up on the bulletin board the last week in June. These possibilities are as follows: Study of trees, common weeds, flowering plants, insect pests, moths and butterflies. Having signed up for one of these classes, and each class is divided and sub-divided intil it has no more than ten members for each teacher, a day is assigned and an hour when these boys and girls meet their teachers. In the tree class leaves are mounted and the fruits are gathered as the fall goes on. This study often continues into the winter and spring when the twigs are mounted and the flowers are forced out of their buds. Common weeds are mounted and their relatives hunted up in the vegetable garden and flower border if relatives they have. Riker mounts are used for our moth and butterfly specimens. Children are taught how to stretch their moths and butterflies and then how to mount them in good shape.

By the first of August this garden very nearly runs itself as any garden should. Our few mechanical helps such as registering and handing in crop reports, and these reports are handed in on slips of paper each period by the child, each slip having on it the garden number of the child and signed with his name, appointing house committees, committees for gathering flowers and vegetables for the poor, the sick, and the new babies which are born during the garden season into the families represented in our garden—all these things help to make the garden run as it should run, and create within its confines a feeling of responsibility and courtesy which should never be lost from the garden. So much has been written on this subject that it is not necessary to go further into this end of our work.

The older boys and girls reckon up the value of our crop at current market prices each week. These prices are obtained by children inquiring local prices in their different neighborhoods, for this garden represents the entire borough of Brooklyn, price lists are also cut from the paper as quoted for wholesale and retail markets. In this way we strike an average price .

I would like to add to this article on gardening that the most important side of the garden has little to do with the crop, and far more to do with those lessons of life which make toward good citizenship rather than just toward good gardeners and good farmers. One is the bi-product of the other. One of the most interesting answers I ever heard to the question of "Why a child should garden" was made by an eleven year old boy this last summer. Dr. Jean Broadhurst of Teachers College, brought her summer school class in nature study to visit the Botanic Garden. The students of the class were told to ask the children why they were in this garden. One young woman told me before she left that as she walked up and down the garden she stopped and asked this lad why he was in the garden. He thought a moment and replied "I come for elementary instruction, because I like to be here, and for my crop." I rather think the small boy put his reasons in their correct order. We go to school and learn our lessons of life which are necessary for the best living, first, because we must acquire a certain body of knowledge, and second, there is nothing in it all unless we enjoy our special work and unless we enjoy life; and third, we are all in life for a definite result from the work we are doing, and the work we like to do.

Gardening as a Part of City Education

J. L. Randall

Director United States School Garden Army, Bureau of Education, Washington, D. C.

To be effective, education must concern itself primarily with the child. Too often, educators becoming lost in the maze of programs of the school day, the school year, and in courses of study, and tests and measurements of subject matter, lose sight of the main objective. There is food for thought in so simple a thing as the dismissal of a large city school. Teachers can easily visualize this dismissal time. The children come down the steps or cement walk two or four abreast and the teacher, the drum major, holds the line in step. There is a suppressed excitement, anticipation, almost an abated breath, that was concealed by the sedentary studies of the school room a few minutes before. When all are in line and acceptably quiet, the teacher, casting a stern glance along the line, says "dismissed". What happens? Pupils go up in the air, they roll over backwards, they race, they wrestle, they fight, they shout—everybody shouts—even the teacher would like to shout. The whole suppressed biological individual is loosened at once . The safety-valve is off. At schools, on lines of street cars and automobile travel, the city must keep a policeman in front of the school building to prevent the children from being killed by darting in front of passing cars. This action on the part of the pupil is hardly conscious. It is nature's demand for physical development.

What of these pupils after dismissal? They go along the paved streets; and, after the first spontaneous outbursts, the conscious must again suppress the unconscious; they must keep out of the way of passing vehicles on the one hand, and "keep off the grass," if there is any, on the other. If it is now the end of the school day, the pupil still has three or four hours of daylight in which to develop the biological being which heredity demands but modern schools suppress. Senses and instinctive interests are all welling up in the child, demanding an outlet with the same explosive, unconscious power as did the physical at the close of school. In the child world at the city home, the broad fields, flowers, birds, and trees, the sense developers of the country, have given place to a city lot that the rush of city life has so often left barren. Modern inven-

tions also have relieved the city dweller of many small duties that are of interest to the child. The small lot cramps the physical child, lack of nature arrests sense development, and modern inventions deprive him of real home interests.

Under the new conditions of the city, there is an imperative demand for a new and broader education, an education based on a study of the child in his new environment. Teachers now feel the need for the introduction of many productive, educative subjects that develop the biological side of the child. For the introduction of these subjects as school and continuation school activities, gardening is paving the way. School supervised gardening as a definite part of our school course is becoming each year more widespread and permanent. Although this subject was first recognized as a branch of education scarcely more than a decade ago, practically all the larger cities have garden departments in the schoo system. Within the past two years, the number of supervisors in sma l cities and towns has increased over two hundred percent. and the increase in garden teachers has exceeded five hundred per cent.

Where school supervised gardening has been introduced as a cont nuation school activity the child has an objective at the close of the daily session. Whether the garden be on the schoo grounds, vacant lot or in the home back yard there is an eager interest to see what nature has unfolded during the day. There are plants to cultivate and weeds to pull that utilize muscular energy. There are flowers and fruits, and insects to satisfy the demands of sense development. There are definite occupations to employ the interests.

The school-directed home garden is the most ecomonic form of gardening for small cities, towns and the suburban districts of large cities. The child's garden becomes a center of interest of the whole family. The food is produced at the home where it is to be used and the home is beautified. As the garden t es the child s interest to the home, the visits of inspection and instruction of the garden teachers tie the home to the school. In the congested sections of large cities, home gardens are not always possible and the community school grounds or vacant lot plot must be substituted. This form of school garden usually requires a greater financial cost in proportion to the value of the crop but is still justified from the standpoint of education.

Five years ago the Congress of the United States recognized this demand of city education by granting an appropriation to the United States Bureau of Education for the promotion of school and home gardening in the schools of cities, towns, villages and manufacturing places. There has been a gradual increase of this appropriation and during the war the President appropriated two hundred and fifty thousand (250,000) dollars for the extension of this work. Out of the experience of several years, the United States School Garden Army idea was born.

The U. S. S. G. A. is an organization of teachers and children who are doing garden work under the direction of the schools. The headquarters of the Garden Army are in the United States Bureau of Education. The plan of organization has been approved by many educators. The spirit of the central office is one of service to the cause of gardening in education. Circulars describing the plan of organization, manuals of garden lessons, and outline courses of study are sent free to teachers. Posters, insignia, and certificates are furnished to children who are doing gardening. The plan of organization of the Garden Army in 1920 is now ready for distribution and will be sent free to teachers who address the United States School Garden Army, Bureau of Education, Washington, D. C.

The city home garden develops muscles, senses and interests.

The Garden Enemies

Masks of paper bags fashioned to represent chewing and sucking insects. One piece garments for the rest of the costume.

A Garden Health Drive

[A revision of its first publication in the National Service Bulletin, March 15, 1919]

ALBERTA WALKER

J. O. Wilson, Normal School, Washington, D. C.

Scene: The Garden Hospital. A row of beds with names printed above them and sick vegetables in them. Reading from left to right—Cabbage Bed, Onion Bed, Potato Bed, Beet Bed, Carrot Bed, Squash Bed, and Bean Bed. The occupants are in varying positions, some propped up, some lying flat, and some having heads bound. All are restless, and some are groaning.

CABBAGE. Anne Onion, if you don't keep still I shall report you to the nurse.

ONION. How can I keep still when I know that Thrips will be after me again?

CABBAGE. What are Thrips compared with the monster Cabbage Worm? I can't sleep without dreaming of the squirming things.

ONION. Thrips not only bite but they suck the life from me. Soon I shall turn pale and die.

POTATO. Your troubles are nothing compared with mine. How would you like to be bitten by beetles? Why they came all the way from Colorado to find me.

BEAN. You amuse me. Wait until Aphids trouble you and you will know what real suffering is. Besides, I have another

trouble, brown spots all over me. I heard the doctor spell it for the nurse and this is how he did it—a-n-t-h-r-a-c-n-o-s-e anthracnose (spelling is done slowly and impressively).

BEET. I am so tired. If you do not stop complaining I shall turn woody. Let's go to sleep.

[*All is quiet. Then the plotters, Thrips, Aphids, Potato Bugs, Cabbage Worms, and other pests come from under the beds.*

THRIP. Ha! Ho! Another delicious supper for me. Where is Anne Onion?

CABBAGE W. He! Ho! Ha! I shall find Cabbage in a moment. How I love to scare him!

POTATO B. Lead me to the Potato bed!

APHID. Ho! Ha! He! I shall take my choice of many. Where is our friend Cutworm?

THRIP. Don't worry about him. He will come after night.

CABBAGE W. Let's say our magic and then begin.

[*Cabbage Worms, Potato Bugs, Striped Beetles, and all other chewing pests form a magic ring on one side, while Thrips, Aphids, and all the sucking pests assemble on the other.*]

CHEWERS. Ho! Ha! He!
Chewers are we,
Beware! Take care!

SUCKERS. Ho! Ha! He!
Suckers are we,
Beware! Take care!

ALL. Ho! Ha! . . .

VOICE OF DOCTOR. So this is the way to Hospital Garden.

VOICE OF NURSE. Yes, Dr. Growem.

APHID. I don't like that voice.

THRIPS. Let's hide.

[*The pests all crawl under the beds. Enter Dr. Growem, who is really Uncle Sam, and Nurse Lady Bug.*]

NURSE L. B. I have tried, Dr. Growem, to take care of this garden, but it is really too much for me.

DR. G. Have you no help?

NURSE L. B. Yes, I have an orderly, Hop Toad, and the bird friends do their best; but as you see, we still have plenty of sick.

DR. G. Humph! I see. Let me look them over.

VOICES OF PATIENTS. I'm so sick, doctor! I'm sicker than the rest! Come to me—me—me!

Farmers and Farmerettes, Nurse Lady Bug and Dr. Growem.
Dr. Growem's Army.

[*As they groan, Dr. Growem goes about from one bed to another examining them carefully and shaking his head.*]

DR. G. Nurse, call my farmers and farmerettes of the School Garden Army. There is much work to be done!

NURSE L. B. Yes, doctor. [*Departs.*]

DR. G. [*rolling up his sleeves*]. Now for business!

[*Enter a number of farmers and farmerettes carrying buckets, sprayers, hand pumps, and watering cans.*]

DR. G. Attention, all! I find in this garden two classes of pests, those which chew and those which suck. What do we use on the chewers, Number 7?

NUMBER 7. Arsenate of Lead, Doctor, used in spray.

CABBAGE W. [*from under the bed*]. What's that he says?

POTATO B. I don't know, but it sounds bad.

Dr. G. Correct, Number 7, and are you equipped?

NUMBER 7. Fully, Doctor.

DR. G. Now, Number 11, your special work will be on the sucking pests. What have you there?

NUMBER 11. A fine kerosene emulsion guaranteed to kill all suckers.

THRIP [*in a scared whisper*]. What did he say about us?

APHID. Sh! They'll hear you!

DR. G. What have you for this poor little spotted bean, Number 13?

NUMBER 13. Bordeaux mixture, Doctor. But be careful, Little Bean, to stay in bed in the mornings until the sun is high in the heavens and do not get your feet wet.

DR. G. Are you ready all? Attention! Sprayers lifted! Hand-pumps filled! Watering cans at sides! Go!

[*The Garden Army begins spraying everywhere*].

VEGETABLES. Stop! You're killing me! This is awful! Mercy on us!

PESTS [*from under the beds*]. Ouch! What? Oh, I'm dying! Let me out! I can't get my breath! Please don't you hurt!

[*The confusion grows, then dies away until everything becomes still.*]

DR. G. Good work, Garden Army nurses! That will do for to-day.

ALL [*bowing politely*]. Yes, Doctor!

DR. G. Now, farmerettes, stay until you straighten up the beds, and clean up the hospital. Nurse Lady Bug, we will leave all in your care.

NURSE L. B. I'll do my best, Doctor.

DR. G. And then in a couple of weeks or so my army will come again. Meanwhile do all you can for the patients, and good luck to you! Come, my men [*looking at his watch*], we will have just time to make the next garden before lunch.

Costumes and Scenery for the Garden Health Drive

DOROTHY KALB

Drawing Department, J. O. Wilson Normal School, Washington, D. C.

The chief value to the children in producing The Garden Health Drive is to fasten the facts in connection with the classes of garden pests and how to conquer them. These are difficult facts for both children and adults to remember. Vividly impressed by simple costuming and the freedom from restraint that the make-believe spirit gives, these facts will be difficult to forget.

The best stage setting is out-of-doors. The garden class at Cornell University, last summer gave it on a plot of ground that was well covered with coarse sod, thus prodiving natural seats for the audience and which had a rank growth of young sumachs and locusts on two sides forming an excellent hiding place for the pests.

Where no natural setting is available a simple conventional background may be made from a roll of light wall-paper painted with black show-card color to represent the palings of a garden fence. In the center and at each side of this fence stand a group of

sunflowers, also painted with show-card color, the center one showing a face painted in the brown seed circle.

The costuming of the characters is as simple as the stage decoration, the only one requiring much work being Uncle Sam. He, of course, should have the accepted costume of red, white and blue, with the high hat.

Nurse Lady-bug is transformed by a large sheet of stiff paper, cut the shape of a beetle's wings and covered with spots. This is pinned to the back of her own dress. The only other adornment is a twisted band of tulle or crepe-paper around the head with two wired feelers in front.

Only the heads of the vegetables show as the children either sit on the grass, or on chairs covered with brown paper or canvas to resemble the garden bed. For the head decorations caps can be made of newspaper pinned round to fit each individual. On these foundations the vegetables represented may be made in crepe paper of appropriate color, leaving the front open for the child's face to peep through. The beet is dark red with flapping green leaves at the top; the carrot, light orange and green; the onion, brown and green; the potato, brown with black eyes painted on it; the squash, bright orange; the bean, Nile green made on flat card board foundation shaped like a lima bean.

The farmers and farmerettes wear overalls, bloomers, smocks, straw hats, sunbonnets or anything suggestive of labor in garden or fields. The tools are those used around the school or home garden.

The "pests" costumes may be made from one piece winter under garments of the small boy spotted with paint or dyed with Diamond dyes, or the little suits may be made of brown cambric cut on straight lines in one piece. The cabbage worm of course should be green.

The head dress, the most fascinating touch of all is the simplest and cheapest. Take an ordinary paper bag, large enough to fit over a boy's head; cut out holes for nose and eyes. Outline these with black paint to add to the weirdness of the countenance. Paint upper and lower sets of large teeth, Jack-o-Lantern fashion for the chewer's mouths; while the suckers have a small round hole, outline the eyes, and if possible are provided with those Japanese toys which curl up and unroll, when blown, like a proboscis.

As there are comparatively few characters and the costuming and staging are so simple, the play can be presented with but little trouble; while a reading of it is certainly all that is necessary to show the opportunity it offers the actors for oral expression, and the wealth of information it gives the audience under the guise of fun.

The fewer rehearsals, especially by the "pests", the better the play will be. Outside of the doggerel "Ho! Ha! He! Chewers are we, etc." there is little to commit to memory. Pests in the garden rarely do the same thing twice so let their representatives do likewise.

Extracts from The Georgics of Virgil

Translated by T. F. Royds, M.A.

When spring awakes, and from the snow-clad peak
Cold streamlets trickle, and at Zephyr's breath
Crumbles and cracks the clod, straight on the plough
Lean until ox complain and share reflect
The deep-ploughed soil. That harvest best of all
Repays the greedy farmer for his prayers
Which twice has felt the summer, twice the frost;
Lo! burst his barns with surfeiting of grain.
But ere the untried surface we explore,
First we must learn the changeful moods of heaven,
And all the winds, and of each several field
The natural character, what this consents—
What that declines to bear. Here cereals thrive,
There grapes more gladly ripen, here again
Green saplings flourish and unbidden grass.

. . . . .

Come then be strong to toil;
Soon as the year begins your stoutest bulls
Must turn the rich land, that the inverted clods
Be baked by dusty summer's riper suns.
But if the land is poor, 'twill be enough
To drive a shallow blade beneath the Bear;
There lest rank weeds annoy the abundant crop,
Here, lest its hard-won moisture leave the sand.

Each second season let the stubbles lie
And arm themselves with solid idleness;
Or 'neath another star sow golden corn,
Where last you harvested the wealthy pods
Of quivering pulse, or else the slender vetch
And bitter lupine with its brittle stalks,
A rustling forest. For repeated crops
Of poppies, sleepy things, or flax or oats
Scorch up the plain, which yet will bear them well
If regular rotation be observed.

Bits of Interesting School Garden History

More than half a century ago, Dr. Erasmus Schwab, a noted Austrian educator, said of the school gardens of his country "that to my mind they are not yet a recognized inheritance of the eighteenth century." A little research shows us that they are a seventeenth century inheritance to the schools of Philadelphia. In 1691, George Fox, the old Quaker willed a tract of land near Philadelphia "for a playground for the children to play on and for a garden for the children to plant physical [medicinal] plants for lads and lassies to know simples and how to make oils and ointments." He thus gives the early idea of plant study for benefit of human ailments that has bequeathed us such names as liverwort, lungwort, toothwort, spleenwort, pleurisy root, mandrake, motherwort.

The correspondence of John Lathrop Motley, the author of the Rise of the Dutch Republic, has been collected in volumes of goodly size. The first eight letters were written to his mother when he was a boy of ten and eleven years of age from the Round Hill School, Northampton, Mass. On May 29, 1825, he writes: "I do not know when I have enjoyed myself so much as I did yesterday (Saturday). In the morning the gardens were distributed and I worked in it an hour before school and in the afternoon we worked a good while in them." May 31, 1825 (to the same) "Our gardens are excellent being eighty feet long and twenty feet broad. Three other boys and myself own one together. We have several beds and have planted a good many things, such as corn, radishes, water and musk melons, etc. I have been working in my garden this morning and very hot work it is. . . . Mr. Bancroft [George H. Bancroft was the headmaster] said that the boys who pleased might work in their gardens and the rest might go in swimming; and I assure you there was not one who did the former." May 13, 1827 [to his father] "We had our gardens given us a week ago. I have got some radishes growing."

The garden was probably not a part of the school curriculum a hundred years ago for wherever mentioned in his letters, Saturday seems to be the garden day. It was probably considered recreational for he incidentally gives his daily school program; French in the morning from half past five to seven; Spanish from nine to ten thirty; Greek until twelve and Cicero all the afternoon which was recited to a German teacher.

Are Exhibits and Prizes of Value?

A. N. Roberts
State Normal School, Potsdam, N. Y.

One naturally wonders if the interest so strongly manifested in school gardens during the war, will be continued now that it is over. The pressure of food production was of sufficient interest then. While high prices for the present will be a compelling force, the time may come when the tax paying public and the children's interest will again be factors for consideration unless the psychological moment was seized by school officials and gardening made a permanent part of the school curriculum during the war.

Throughout the state of New Hampshire the school garden work culminates in an exhibit of products. It is considered one of the best factors in the program of supervised gardening for it not only retains the interest of the children during the year but gives a comprehensive idea to the public which furnishes the money, of the work the schools are accomplishing. In many communities such exhibits are a surprise as the people do not realize what the children are doing. They see not only good returns for well spent labor but the educational value as well.

The time for holding the school garden exhibit will have to be determined by local conditions. It should be when the crops are in good condition, when both flowers and vegetables are at the height of bloom, fruit and foliage. This will usually be about the second or third week of September in this latitude.

The place where it is held should be easy of access and a place where the exhibits can be displayed to the best advantage. If it can be held in the gardens or near them so much the better, for visitors would then have the opportunity to see how the work is conducted. Access to a large assembly hall where a program can be given is also desirable. This program may include garden essays, a play or a pageant. If the children have written the play so much the better. "The Garden Health Drive" published in the current number of The Nature-Study Review is quite easily produced and the simple costuming most pleasing.

Awarding the prizes should be a part of the program.

This brings up the question should prizes be offered? Judging by the common practice through out the country I would say

that most people think they should. The first prize is considered a proper incentive to promote interest and honest effort in competition.

There are others who hold a different view. They claim that children should have higher motives.

Miss Carter, Supervisor of School Gardens of Philadelphia, Pa., says "In regard to prizes—a few have been awarded, but this is not generally done as the aim is to have the children work without the idea of a prize always in view. It is to be desired rather, that they work for the love of the garden and for the production of crops."

I believe that this is the ideal which we should strive to attain but in the early stages of development in school garden work, in which many of us find ourselves, I *believe* we should use every honest means in our power to create and to maintain the interest of the community in any thing that promotes its welfare and is for its highest good.

In distributing such prizes it is best to give them to a large number of children and thus avoid the feeling of disappointment and discouragenemt which so often holds over when only a few prizes are given. A large number of inexpensive prizes serve the purpose. Ribbons and certificates are really sufficient. For the coming season such certificates may be secured from the Bureau of Education upon application. It is an honor for future use to have a government certificate. For the benefit of teachers, looking forward to securing such certificates the 1920 Circular of the United States School Garden Army is quoted verbatim:

Certificates.

A certificate, signed by the Secretary of the Interior, the Commissioner of Education, the Director of the U. S. S. G., and a space left for the signature of a local official, has been engraved. This certificate will be presented at the end of the garden season to children who have achieved a real success. Standards for awarding the certificate will have to be left largely to the local supervisors or teachers. These standards should be high, but such as can be reached by all children who make an honest effort.

Record blank

A sample record blank is being printed which can be adopted by local communities. Its adoption by many cities will establish a uniform standard for awarding certificates.

A Suggestion for Bird Protection

NELLIE HARRINGTON

Washington, D. C.

A student-teacher in a city Normal School wrote the following letter to the 3B Grade in which she was receiving her training, as a device for arousing interest in birds. It was enclosed in an envelope, directed to the school, stamped, and postmarked "Birdland." A messenger from the principal delivered it, just as the spring bird study began. The children's answers came spontaneously. A few of them are published just as they were passed to the teacher, showing that feeding birds is a child's first idea of the protection for which she pleads. "A little child shall lead them." It is only an unnatural spirit that would torture or destroy the lives that he has fed.

Dear Boys and Girls of 3B Grade:

We know more about you than you think we do. We know how good you are. We have hopped about the roofs, and looked in at your windows.

We have built our nests in the trees, and sung many a song as we flew about the gardens and parks.

We are Americans, just as you are. Birds like us welcomed Captain John Smith and his men when they came here many years ago.

Now we have a sad story to tell you. Thoughtless people are trying to destroy us. They kill us because our feathers are beautiful. If this goes on much longer, all your song birds will be gone.

Now we ask you to do your part in saving us. If you will, we know how to pay you. We will play about your flowers—ourselves like flowers on wing. We will destroy the insects and worms that spoil your cherries, apples, and roses. We will give you our best songs, and make the spring more beautiful.

Every morning when you go out, the Robin will fly after you. The Song Sparrow will tell you how grateful we are. We know where we are safe.

Your feathered friends, Robin, Song Sparrow, Bluebird, Cardinal, Woodpecker, Swallow, and Oriole.

All our relatives on wing.

A few letters written by the 3B Grade in answer to the foregoing letter from Birdland.

Dear Feathered:

I received your letter, glad to hear from you. I am going to make a house for you in my backyard and every morning there will be some bread for you. I am going to have a garden and I will thank you if you will eat the worms and insects so my garden will grow.

From your friend,

STANLEY S.

Dear Birds:

We are sorry you are starving and if you are, please come to 1310 Girard street, N. W. You will see a house for you and some food. I hope you will call for I am very willing to feed you.

Your friend

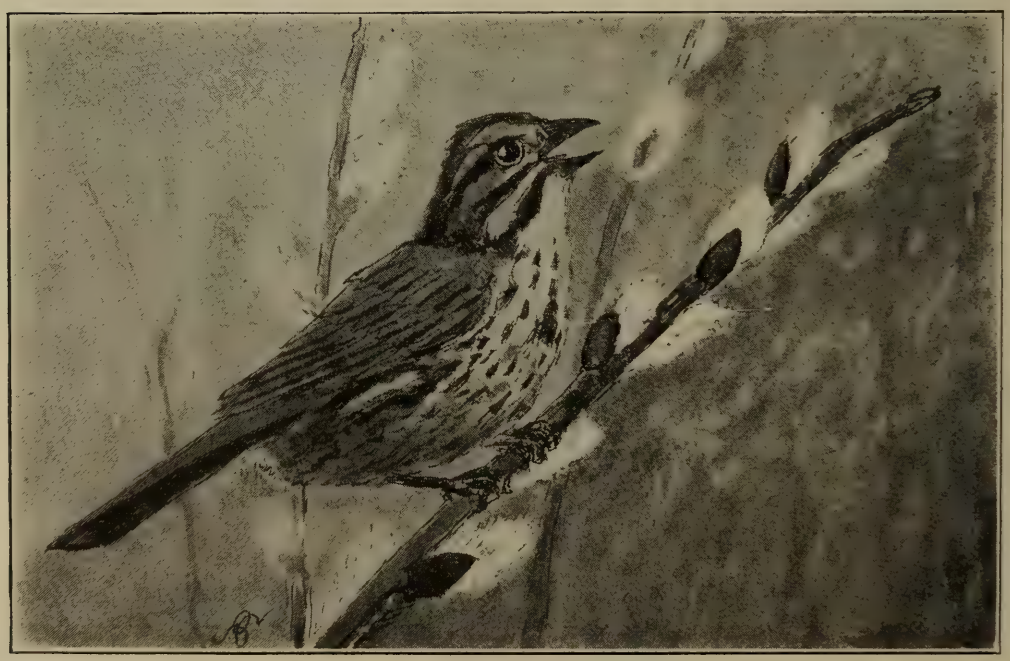
FRANK.

Dear Birds:

I am going to try to get a few bread crumbs for you if I can, for I live in a boarding house and I can't get much for you.

From your friend,

JAMES L.



The Song Sparrow

The Bagworm Drive

Anna Parfitt Barton

During the fall of 1919, trees in District of Columbia were infested with bagworms. They appeared on the trees and shrubs in nearly all parts of the city. As an object lesson and part of the nature study work a "Drive" was instituted among the school children by the corps of Nature-Study teachers. The history and habits were carefully studied in the classes of the upper grades and the boys and girls impressed with the importance of destroying them.

On the completion of the lesson, the enthusiasm of the children led to numerous expeditions being organized after school hours for the purpose of collecting bagworms. Yards both front and back were visited and many a housekeeper found out for the first time what was causing her evergreens to look so bare and dead. Willing permission was given by many of the prominent citizens to the boys to scout their lawns and estates for the pest. A frequent scene was groups of children on these collecting tours among the shrubbery along the streets and in the parks.

The cocoons were brought into the class rooms where they were counted and scores posted for each class. The drive was competitive and by posters and the awarding of gold stars, interest was maintained. In one class each member, at first, pledged one hundred bagworms; in a week raised the pledge to two hundred; by the third raised it to five hundred, and not one of them failed to reach this number.

In some neighborhoods the trees were entirely stripped of bagworms. One boy collected over two thousand and the class of which he was a member collected more than sixteen thousand. The "Drive" lasted four weeks. The total number reached was over one hundred thousand. When it is borne in mind that each female cocoon contains approximately one hundred eggs the result is startling. These figures are quoted from actual record and tend to show the magnitude of the work.

At first, it was the intention of the nature study corps to make a feature of the burning of the cocoons in front of the class. Further study and investigation led to another ending of the story. These cocoons, although apparently well protected from attacks of the birds, are visited by a parasite fly that lays her eggs among those of the bagworm. The parasites hatch out first and feed upon their

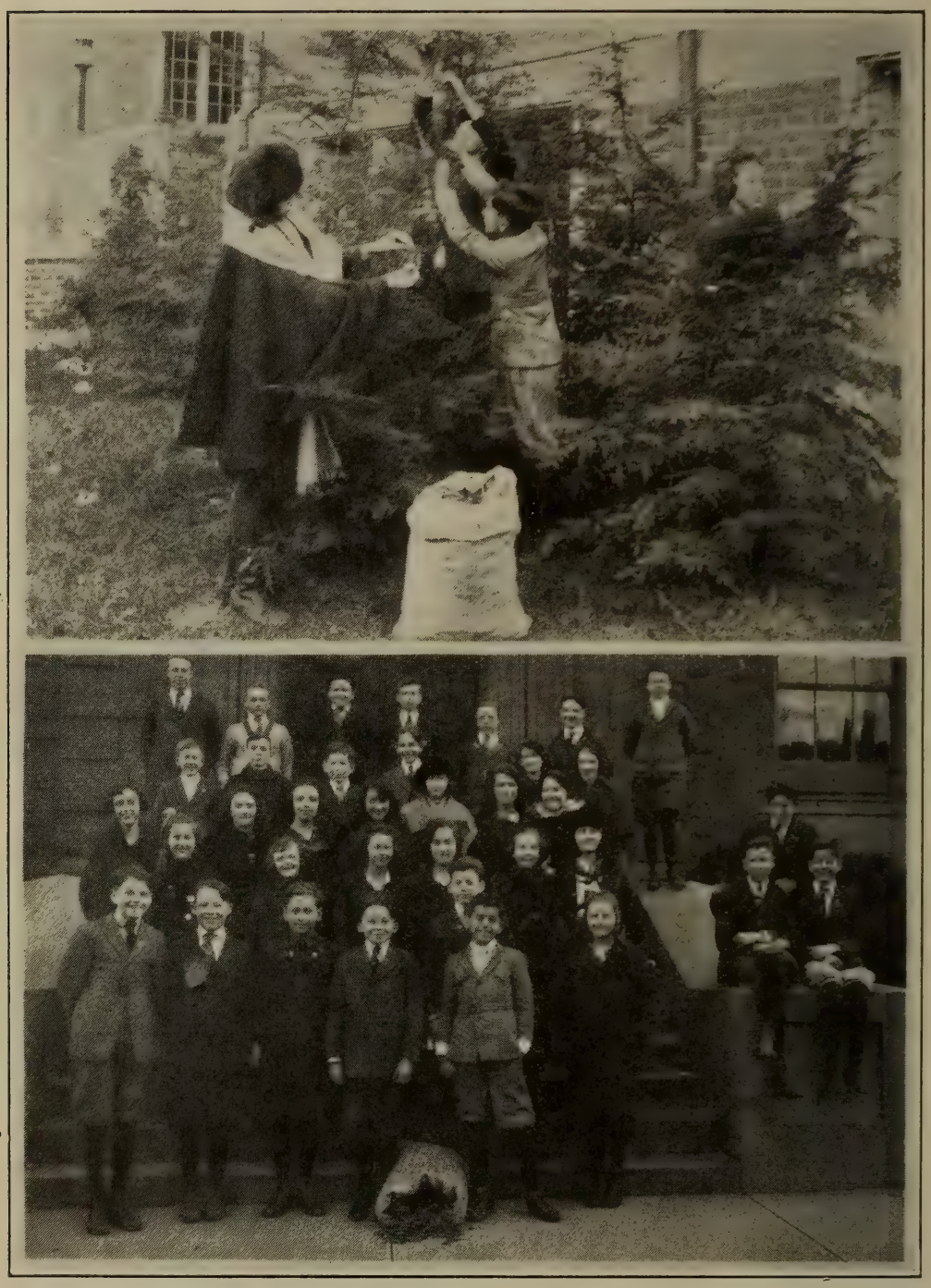


Photo by E. L. Crandall

Gathering bagworms from the school evergreens

The School that gathered 16,000 bagworms
The boy at the right of the bag was the expert in the drive, his record was 2,000

host and escape as a winged insects to prey upon others. If, as originally planned the cocoons had been burned the parasites would have been destroyed, so it was determined to preserve the cocoons and capture the fly.

The method pursued is not without interest. The cocoons were put in sealed boxes and inverted test tubes inserted through the sides somewhat resembling minature forts. The parasites seeking daylight will fly into these tubes. This will give the class a very wonderful and "close up" study of the enemies of the bagworm such as they would otherwise be unable to obtain. At the proper time, the parasites will be liberated to prey upon those cocoons which were so high up they could not be reached or so camouflaged they escaped the eyes of the boys and girls.

The value of this "Drive", aside from teaching the children the history of the bagworm and its enemies impresses upon us the benefit to be derived from supervised co-operation. If the children of Washington, D. C., in this one effort could obtain such excellent results, how much could the children of this United States accomplish under well directed supervision, such as a trained corps of nature study teachers in all our schools? Naturally this furnished good material for written work in the schools. The two compositions following represent extremes of interest.

January 13, 1919.

How I Got My Bag Worms

A short time ago our nature teacher told us that she wanted us to do something that would help the city and teach us a great deal. We were to enter a "Bag Worm Drive" to last two weeks.

I admit I was very lazy the first week, but toward the end of it I went to an empty lot near by and seeing a few bag worms high in one tree, tried to push them off with a stick. Failing in that I looked around for more. I then remembered that they were mostly on evergreen trees so I went to the other side of the lot where a group of evergreens stood and to my surprise they were covered with bag worms. I had only brought a small oyster box and I soon had that filled. I looked around for something else to put them in and seeing a newspaper I put the bagworms on it. I had filled the box three times when a policeman came up and asked me what I was taking off the trees. I told him I was gather-

ing bag worms for our nature teacher. and that they were very destructive to the trees.

He said, "All right, you can get as many as you like," and then picking one up he said, "Why they are just like silk worms."

I showed him the inside of one and said, "This little worm is like a silk worm in appearance, but it is very harmful. It not only makes its little house out of the leaves or needles of the tree but eats them too.

He said he hoped all the school children in Washington would help get them.

I worked till about sundown and was very much pleased over my work. That evening I counted them, and I had six hundred and twenty.

When each pupil's final total was summed up, I had nine hundred and fifty, this was the third highest in the class.

It will be one of my pleasant remembrances of my school life in Washington to feel I have done my little to help keep the trees and shrubs beautiful.

KATHRYN RIPLEY SMITH.

January 13, 1920.

MY REASONS FOR LACK OF GETTING BAGWORMS

In the nineteen-twenty class of the Ross School, Washington, D. C., there was a contest being staged on the harmful insects known as bagworms.

When the contest ended, the number of worms which had been gathered approached the fifteen thousand mark. I was only able to get seven of the number because it was not a thing that I will call interesting. I indulged in procrastination and the results brought were worthless, I, at the bottom of the class and the leader having gathered over two thousand alone. "Never again," quoth the raven and I.

If any such contest is staged once more, I will be near the front or I will know the reason for my failure.

LOUIS NUBER.

Some Enemies of the Garden

Glenn W. Herrick
Professor of Economic Entomology, Cornell University

It is unfortunate for us that there are other creatures who appreciate the excellent quality of our vegetables as food quite as much as we do. Therefore it is quite necessary for the gardener to get acquainted with all of these depredators and learn to know them by sight and by name and also to understand their ways of life, so that he may know how to get rid of them.

Enemies of the Cabbage Family

There are many insects that enjoy feasting upon the leaves or stems of cabbage, turnip, and cauliflower. The more important ones are the imported cabbage worm, the cabbage maggot, the cabbage aphid, the cabbage looper and certain cut worms.

The Imported Cabbage Worm: We all know this as the common green velvety caterpillar that gnaws holes in the leaves of cabbage in nearly every garden. These are the offspring of the pretty white butterflies which we see fluttering over our garden looking so innocent. The male butterfly has two black spots on the front wings and the female one.

The mother butterfly flits rather rapidly over the cabbages occasionally dipping downward now and then to a cabbage and stopping a moment to deposit a cream-colored egg on a leaf. This egg hatches in a few days into the velvety caterpillars that grow fast and eat ravenously often devouring much of the outer leaves and working down into the heads. They not only eat into the cabbage head but they muss it up by depositing brownish masses of refuse material. The caterpillars reach their growth in about two weeks when they change to chrysalids and in about a week more the butterflies emerge. There may be three generations a year each generation usually becoming larger in number than the preceding one.

This common cabbage pest is best controlled by spraying the plants with a soapy solution of arsenate of lead. The mixture is made by dissolving four pounds of laundry soap in 4 or 5 gallons of hot water and then adding enough water to make 50 gallons. To this there should then be added three pounds of paste or one and one-half pounds of powdered arsenate of lead. The spraying should

begin early so as to catch the first broods of the worms and may be continued a long time as a cabbage grows from within outward and there is no danger of the poison being enclosed within the head.

Another and perhaps simpler method of control for the home garden is by dusting the cabbages with powdered arsenate of lead, one part by weight to four parts of air-slaked lime. A cheese-cloth bag is convenient as a duster. The material should be applied preferably when the dew is on so that it will stick to the leaves.

Cabbage Maggot

The Cabbage Maggot: The parent of this pest is a very small fly, so much smaller than the house fly that one would never suspect that it could do so much mischief; it deposits its white eggs in crevices of the soil near the base of the cabbage plants. Here they hatch and the small white maggots burrow into the roots or tunnel along the surfaces of the roots. The maggots completely destroy the root systems of young plants, check their growth, and cause them to wilt and die. The maggots are also very injurious to young plants in the seed bed.

For great fields of cabbage the most effective method of control is by surrounding the stem of each plant as soon as it is set by a hexagonal disk of tarred paper which may be bought of dealers at two or three dollars per thousand. But for the home garden the following method is advised: Make a slight depression about the stem of each plant and pour into it a tablespoonful of crude carbolic acid emulsion made as follows: hard soap, 1 pound or soft soap 1 quart; boiling water, 1 gallon; crude carbolic acid, 1 pint.

The soap should be dissolved in the water and the carbolic acid added. Then the mixture should be churned rapidly until a creamy white emulsion is formed. This should then be diluted by adding 30 times its bulk of water. That is, a teacupful of the emulsion should be diluted with 30 teacupfuls of water and then a tablespoonful of this diluted solution put in the depression about each plant.

The Cabbage Aphid: This plant louse like its other relatives is a little rascal from the gardener's standpoint; its mouth is in the form of a sucking tube which it inserts into the tissues of the plant and sucks up its juices. The cabbage aphids occur in enormous numbers on the cabbages in larger fields but is not found so

much in gardens. They are greenish in color and covered with a fine whitish powder. They cluster on the upper and undersides of the leaves and suck out the juices of the plant causing the leaves to curl, wilt, and finally die. In the beginning of the infestation the aphids are wingless but later, as the plants become crowded, winged ones appear that fly to other plants where they start a new infestation. It is by means of these individuals with wings that the pest is gradually distributed all through a field.

Since aphids are sucking insects they must be controlled by some substance that will kill them when it comes in contact with their bodies. Kerosene emulsion will do this very effectively but as it is rather bothersome to make; a tobacco extract known as nicotine sulphate, is much more universally used to combat these pests. Nicotine sulphate is a commercial preparation, the more common brand of which is known as black-leaf-40; it contains 40 per cent. nicotine. For spraying most garden vegetables infested with aphids or other sucking insects the black-leaf-40 is added to water at the rate of three-fourths of a pint to 100 gallons of water or, in smaller amounts, one teaspoonful to a gallon of water. About three-fourths of an ounce of laundry soap should be dissolved and added to each gallon of the mixture. The soap increases the efficiency of the solution. Care should be taken to spray the undersides of the leaves.

The Cabbage Looper: This caterpillar does not waste its time by taking short steps with many little feet as do most caterpillars. It reaches as far as it can with its front feet, takes hold then brings its hind feet forward as far as possible by looping its body, thus each step is measured by the length of its body. When we were children we used to call the loopers "measuring worms" and rather enjoyed having them measure our hands and fingers. The true loopers are caterpillars of very delicate and beautiful moths whose wings are marked with wavy lines. The cabbage looper belongs to another family and in some parts of the country is a very troublesome pest especially to late cabbage. The caterpillar is from 1 to 1⅜ inches in length when full-grown, is pale-green in color and indistinctly striped on the back and on each side with whitish lines. It moves about with a looping gait like the common measuring worms. On Long Island there may be three broods of the insect in a single season.

Since this insect passes the winter usually as a pupa within a light, silken cocoon, clean culture is most useful in holding the pest in check. The old leaves, stumps, and heads lying in the fields may harbor the overwintering pupae in their cocoons. Therefore all refuse in gardens and fields should be gathered in the fall and burned or otherwise destroyed. This is an important practice also in the case of other garden pests.

In addition the poison mixture of soap and arsenate of lead recommended for the imported cabbage worm is useful in case of the cabbage looper. The spraying should be done using great care to cover all parts of the plant.

Cut Worms: The cut worms are thieves that usually work in the night and there are several species which cut down our young cabbage plants.

Cutworms are sleek, robust caterpillars from one to two inches long. They are yellowish, greenish, dirt-colored, or grayish and sometimes striped or variously marked with dull dark or brown areas. They hide beneath some object on the ground or crawl just below the surface of the soil during the day, coming out at night to do their feeding. They cut off the stems of the small cabbage plants and one cutworm may, during the night, destroy several plants in this way. When grown, the cutworms change to pupae in the soil and the pupae eventually transform to dark-gray or brownish moths which lay eggs for a new generation.

Clean cultivation by burning all refuse and ploughing deeply in the fall is of advantage. Eggs laid on leaves of weeds will be destroyed and many of the half-grown cutworms will be killed by deep ploughing.

Poison bait made of bran 10 pounds, paris green 1 pound, and molasses 1 or 2 quarts, is very effective. Enough water should be added to moisten the bran so that the particles will adhere to each other and yet not so much as to make a soft mash that will not crumble. A handful of this mash should be placed around each plant or it may be scattered thinly between the rows.

The following bait has also proved very effective: Shorts 50 pounds, molasses one gallon, Paris green one pound, and water one and one-half gallons. The shorts do not dry out as quickly as bran.

Enemies of Cucumbers and Squashes

The delicate young plants of cucumbers, squash and melons are often destroyed by the striped cucumber beetle; and if they survive this pest, as full grown vines, they may be attacked by the squash bug and the squash vine borer.

The Striped Cucumber Beetle: This little pest is about a quarter of an inch long and has a black head with wing covers of orange yellow with three black lines down the back; this striped uniform suggests that this little rascal ought to be in prison but he usually isn't. The beetles appear early in the spring before the cucumbers are up and feed on nearly everything they can find. When the cucumber plants appear above the ground the beetles begin at once to feed on the first tender leaves riddling them with holes. Later they feed on the blossoms especially the pollen and on the foliage of the vines. They are ravenous eaters, often very abundant and persistent in their attacks and in many gardens cause the most severe injury.

Their yellowish eggs are laid in cracks and crevices of the soil where they hatch into white slender larvae that burrow into the tissues of the roots of the vines. The larvae cause some injury to the roots but it is not as severe as the injury caused by the beetles on the vines.

Clean culture about the borders of the garden to destroy the hibernating places of the beetles and to prevent the growth of the weeds in the early spring is of considerable value in the fight against this insect.

Young plants may be protected with screened boxes or covers. A box without top or bottom set over the hill and then covered over the top with muslin or wire screening will protect the plants from early injury. A barrel hoop cut in half and the pieces crossed in the middle with the ends stuck in the ground and then covered with muslin will serve the same purpose. Any cover of this kind must be removed after the vines begin to run.

Dusting plants heavily at frequent intervals with air-slaked lime or tobacco dust will repel the beetles and if persistently followed up will protect the plants satisfactorily.

Spraying the plants and keeping them well covered with paste arsenate of lead, 2 pounds to 50 gallons of water or Bordeaux mixture is effective.

The Squash Bug: This is another insect that thrusts his bill into the plant tissues and sucks up the juices. When it is full

grown it is about five eighths of an inch long and is mottled with dark brown and yellow. When it is young it is light green in color.

The full-grown insects pass the winter hidden in nooks and crannies under boards and rubbish wherever they can find a snug retreat. They appear in June here in the North as a rule and at once attack the young plants by inserting their beaks into the leaves and sucking out the juices. Later the bugs deposit their brown eggs on the undersides of the leaves often in regular rows. The eggs hatch in from one to two weeks and the young green bugs cause severe injury by feeding on the foliage. There is fortunately but one generation a year.

About the only effective method of control in a garden is to catch the overwintering bugs by hand before they deposit their eggs. The bugs may be caught most easily in the early morning before they become active. If pieces of boards, bark, shingles, or similar objects are laid on the ground the bugs will crawl beneath them and may be caught and killed in the early morning. A close watch must be kept for the bugs as they appear in the spring so as to catch them before they deposit their eggs. If the eggs are deposited they should be crushed or scraped from the leaves with a knife. The young bugs may be hand-picked or they may be killed by spraying with nicotine sulphate, 1 pint to 50 gallons of water to which 4 pounds of soap should be added.

The Squash Vine Borer: This borer is a very secretive and and troublesome enemy, for it works inside of the stem of the vine and is not discovered until after it has done much damage. If we saw the mother moth flying swiftly about the garden we would never suspect that her young could be so diasgreeable and injurious. She is a very beautiful moth with hind wings as transparent as glass and with her body beautifully marked with orange or red and black or bronze; she measures something over one inch across her extended wings.

The moths emerge from their pupal cells in the ground from the last of June to the middle of July. The moth lays her oval dull-red eggs on all parts of a plant but principally on the stems. The eggs hatch in from 6 to 15 days and the young caterpillars bore into the leaf stalks and the stems and then burrow along the centers. When the caterpillars are full-grown they go down into the ground from one to two inches and change to pupae in earthen

cells where they remain all winter. Injury is greatest to the Hubbard and other late varieties.

In the first place, gardens which are troubled with this insect should be harrowed thoroughly in the fall to break up the pupal cells and bring the pupae up to the surface where they will be winter killed. Early in the spring the garden should be plowed deeply in order to bury any pupae that may have lived through the winter.

If infestation is anticipated, the stems of the squash plants should be covered here and there with dirt as they begin to run. The stems will send out, at the points where they are covered, secondary roots which will support the plants in case the main stem near the base of the plant is killed by the borers.

Finally the borers may be cut out by hand. They can be located by the small heaps of sawdust-like borings on the soil just under the stems where each borer is working. The vine should be slit lengthwise and the borer killed.

The Melon Aphid: Sometimes we find our melon vine covered with enormous numbers of plant lice and we know that there is no use in trying to feed them poison by spraying it on the leaves. But luckily for us their bodies are very soft and sensitive and their numbers may be controlled by thorough and careful sprayings with nicotine sulphate at the rate of one teaspoonful to one gallon of water with an ounce of soap added to increase the sticking and spreading powers of the liquid. An angle nozzle should be used so that the undersides of the leaves may be reached with the spray.

Enemies of the Irish Potato

The Colorado Potato Beetle: This is another little pest whose stripes suggest a prison garb. It is brownish-yellow in color with ten black stripes along the back. It is the most important insect enemy of the potato; it passes the winter usually deeply buried below the surface of the soil but sometimes simply beneath rubbish. The beetles appear early in the spring by the time the plants are up and after feeding for a few days begin to deposit their orange red eggs on the undersides of the leaves in groups of 25 to 50. The eggs hatch into soft, reddish grubs that devour the foliage; often leaving nothing but the bare stems. In from two to three weeks the grubs mature and then go into the soil where each one changes to a pupa. In about two weeks more the beetles emerge for a second generation.

Paris green at the rate of one pound to 50 gallons of water is an efficient poison for this insect but this amount should be applied to each acre of potatoes. Where Bordeaux mixture is used on potatoes for the blight, the Paris green may be combined with it. If the poison is used alone it will be best to add two or three pounds of quick lime to prevent any burning of the plants. If paste arsenate of lead is used, at least four pounds to 50 gallons of water or of Bordeaux mixture will be necessary. The first application of poison should be made early while the plants are small.

Paris green may be combined with flour or air-slaked lime at the rate of one pound of the former to 20 pounds of the latter and dusted on the plants from a muslin bag preferably while the dew is on. Powdered arsenate of lead at the rate of 1½ pounds to 20 pounds of lime can be used in the same way.

The Potato Flea Beetle: This isn't much larger than a flea and it acts very much like one when disturbed, for it is only about one-sixteenth of an inch in length and has very strong hind legs and it is indeed very hard to catch for it is a famous jumper. They are black and sometimes occur in great numbers on potatoes, tomatoes, and egg-plants to which they are very destructive. They live on the undersides of the leaves and finally cause the foliage to become fairly riddled with small, shot-like holes. The leaves wither and roll up and the plant when badly injured looks as though it had been scorched.

The most effective way to control the flea bettle is to keep the plants covered with Bordeaux mixture. The plants should be sprayed every 10 to 14 days for the blight and pains should be taken to cover the under sides of the leaves. Poisons do not seem to be effective although when they are used for the Colorado potato beetle probably some flea-beetles are also killed.

Enemies of the Tomato

The tomato seems to be a plant attractive to several insects all of which do it much damage. The potato flea beetle just described likes the tomato as well as it does the potato. The cut worms also mow down in the night many young tomato plants. The methods of fighting the flea beetles and cut worms have been described.

The Tomato Fruit-worm: This is the young of a rather handsome brown moth and eats cavities into the sides of both ripe and unripe fruits. When young it may attack the stems and leaves

of the plant but as soon as the fruit sets it goes to the young tomatoes and attacks them as described. This tomato fruit-worm is the same caterpillar that gnaws into the tips of ears of corn and farther south it works in bolls of cotton. In fact it is known as the corn ear-worm and the cotton boll-worm.

It is possible and practicable in a home garden to collect and destroy the caterpillars by hand. When tomatoes are found with the caterpillars wholly buried within the fruit they should be picked and destroyed. At the end of the season the vines and fruit, if infested, should be burned or otherwise destroyed.

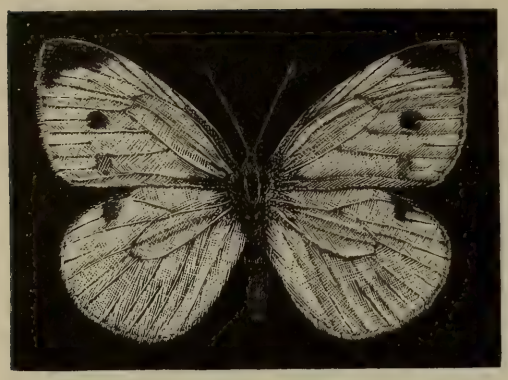
The Tomato Green Worm: This is a magnificent caterpillar when fully grown, often measuring four inches in length. It may be dark green or brown and has eight whitish V-shaped marks on each side of the body; it has a horn near the posterior end of the body and has a way of rearing up when disturbed that is very impressive. It is the caterpillar of a large sphinx moth and it is also known as the "tobacco worm."

These large caterpillars eat ravenously and sometimes consume considerable foliage although they are usually not abundant enough to cause serious injury. They may ordinarily be controlled by hand-picking.

The Enemy of Radishes

The radishes are fortunate in having but one insect pest, as a rule; but are unfortunate because this pest is such a nuisance and does so much damage. It is in fact the common cabbage maggot, the larva of the little fly. These maggots are sometimes so abundant that they burrow through and through the radish interiors causing decay; and what is even worse, when they are not so numerous, we sometimes eat them inadvertently, which strange to say, we regard as a greater hardship to us than to the maggots.

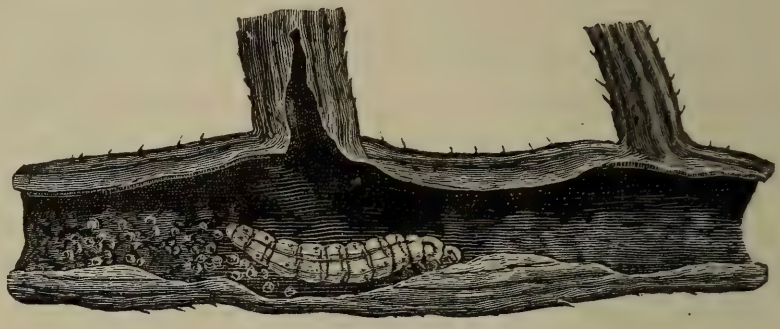
There are two practicable methods of fighting this pest on radishes. First, experiments have shown that when radishes are sown early enough so that they can be pulled during the latter part of May or certainly by the first week in June in Central New York they will not be injured to any extent by this insect. Second, it has been shown that radishes grown under muslin, will grow more rapidly, become more succulent and tender and will, of course, be entirely free from maggot injury.



The Imported Cabbage Butterfly

The adult of a cut worm

The Squash Bug



The SquashVine Borer

The Proper Way to Make Mixtures for Spraying

The wise gardener keeps certain materials on hand so that he can make up his spraying mixtures as soon as they are needed. It must always be remembered that the poisons we use to kill insects are also poison to us and that we must handle with care.

Kerosene Emulsion.—This emulsion is made by dissolving one-half pound of laundry or ivory soap in one gallon of boiling water and then adding two gallons of kerosene oil. As soon as the oil is added and while the mixture is hot it should be vigorously churned or pumped back into itself until a white, creamy emulsion is formed. For spraying plants in leaf, it should be diluted by adding 17 gallons of water. This mixture is valuable in spraying for plant lice and young squash bugs.

Bordeaux Mixture.—Bordeaux mixture is primarily a fungicide and used to control fungus diseases of plants but is also our chief reliance for checking the potato flea beetle as already described. It is made as follows: Dissolve four pounds of copper sulphate in 25 gallons of water. Then slack four pounds of stone, or quick lime by the gradual addition of water until the lime has become thoroughly pulverized and then add enough water to make 25 gallons. The two solutions should then be poured together thus making 50 gallons of Bordeaux mixture ready to apply.

THE NATURE-STUDY REVIEW

DEVOTED PRIMARILY TO ALL SCIENTIFIC STUDIES OF NATURE IN ELEMENTARY SCHOOLS

Published monthly, except June, July and August. Subscriptions price, including membership in the American Nature Study Society, $1.00 per year (nine issues). Canadian postage 10 cents extra, foreign postage, 20 cents extra.

Editorial

While editing the material for this garden number the thought came to us "How little information there is in this number on the growing of turnips, cabbages, geraniums, roses, etc.!" And then the answers came "But there is much in it on how to grow children and that is the crop, as teachers, we are interested in." For facts on vegetable and flower crops THE NATURE-STUDY REVIEW refers you to and urges you to use freely, the manuals issued without charge by the Bureau of Education, Washington, D. C., viz.: A Manual of School Supervised Gardens of the Northeastern States. Part I Vegetables, Part II Flowers. When sending for these ask for copies of the record sheet and certificates of work. You may not have time to organize a company of the United States School Garden Army but a certificate for work done attested by the Bureau of Education is a valuable incentive. If you are a teacher in the far West send to the University of California for Outlines of Courses of Instruction in Agricultural Nature-Study and Outline Studies on School Gardens, Home Gardens and Vegetable Growing Projects.

Now, wherein have we shown you how to grow the child crop? Read and re-read the first article to find how a child acquires self control; control of others which can only come through self control; ability to follow directions; independence of work and yet a feeling of responsibility to the entire community, in an efficiently managed garden.

Study the Garden Health Drive for the use of the imagination in teaching a difficult subject. We have seen this play most successfully given when the final production was the only time all of the actors had been together.

As one reads the reports of supervisors from California to Massachusetts he is impressed with the earnestness of those who are truly sowing seeds of character and while they may never reap the crop they are sowing, their work will live long after them.

Reports from Garden Supervisors

WALTHAM, MASSACHUSETTS

In February throughout all grades above the third, we begin our plans for the spring work. In the upper grades kinds of soil, drainage, seed testing, choice of seeds, vegetables best adapted to certain conditions and finally proper planting, cultivation and care are taught. These subjects are in many cases demonstration lessons and are simplified for lower grades.

We have had a most successful and enthusiastic little army here for two years and although, generally speaking, the war is over, I think the high cost of food will make the boys and girls realize that Uncle Sam still needs their help.

We organized in companies of eight to fifteen soldiers with a captain and one or two lieutenants. The lieutenants were responsible to the captain and the captain to the garden supervisor. Throughout the spring and summer months meetings for the officers were held to discuss questions which troubled them and to make reports on their inspections, for this was part of their work, keeping a list of the members of their company and inspecting to see whether or not they were being loyal soldiers, keeping out weeds, cultivating, etc.

In the early spring a garden pageant sent out by the Director of the U. S. S. G. A. and revised for practical use was presented by our army. It was a success and added greatly to the interest in garden work. The entire city was interested for each school was represented. The correlation with other subjects was splendid. The posters and costumes were designed and made by the drawing and sewing classes. Language work and music also had a share.

For two years we have had a U. S. S. G. A. parade, companies from all schools led by their officers only and carrying various mottos and flags designed by themselves marched like true soldiers. A float was a great addition to the parade last year, children from the pageant who had been flowers and vegetables, etc., making a very effective picture.

Officers of the army kept note-books with the ratings of each member of their company. They inspected every two weeks and reported to the garden supervisor at the end of that time.

Waltham had all kinds of gardens from the very small one of early vegetables to that of half an acre or more on the outskirts of the city. An exhibit was held in the fall in connection with the Grange and prize ribbons were presented winners. Certificates signed by Washington officials and our Mayor were presented to successful gardeners by Mr. Weed and the "1919 garden season" closed with an entertainment for the children.

As gardening is not counted as a school subject with credit given, the organization of the U. S. S. G. A. has helped greatly I think in making the children keep at it. There are always the lazy ones; but most of the children hated to be thought slackers. After two years of work in the elementary schools here, a manufacturing city, I should like to state that I think garden work and nature study made interesting and attractive to our boys and girls can be one of the biggest factors in Americanization and in teaching a sane, clean and happy outlook on life.

Mabel J. Weeks, Supervisor

UNITED STATES SCHOOL GARDEN ARMY, LOUISVILLE, KENTUCKY

Emilie Yunker, Supervisor

U. S. S. G. is popular in this city. Seventeen thousand sixty-four children pledged themselves to raise one or more food crops. Eight schools, in 1919 had one hundred percent. enrollment. The members of the army worked out their pledge on 32 school gardens covering eight acres of land and in 8830 home gardens. The estimated value of the school garden crops is $1,560; of the home gardens $80,403. For this financial return the Board of Education expended $4,157.50. In every detail, these schools carry out the suggestions of the Bureau of Education. The manuals furnished are used in lesson planning. The home gardens are supervised by twenty-five teachers. A few of their reports of home gardens are interesting.:

	Age	Size of Garden	Cost	Crop Gathered
Joseph Hess	13½	70 ft. by 120 ft.	30c. and seeds from last year	$150.00
Florence Bruner..		50 ft. by 105 ft.	$6.20	$ 32.60
Gladys Dixon		50 ft. by 100 ft.	$4.15	$41.90
A. D. Shelbourne	11½	50 ft .by 100 ft.	10c. and seeds from last year	$125.00

A unique feature of the Salisbury vacant lot garden was a fine crop of broom corn. Twenty-four hand made brooms, selling at 75c a piece and enough seeds to sow ten acres came from this plot, the original seeds being saved from two volunteer plants sown by birds the previous year.

Board of Education—Department of Superintendence—Grant Building, 17th and Pine Streets

school gardens—november 1919, philadelphia, pa.

The School Garden season opened April 1st, 1919, with 15 regular school gardens in session and 49 victory gardens.

The term for these gardens was seven months, from April 1st to October 31st.

One supervisor directed this work, which was in charge of 49 teachers, who with the aid of eight gardeners, organized and carried on the work in their respective gardens throughout the season

Many of these gardens were the means of helping to humanize and educate the communities in which they were located. In one instance an unsightly dump was transformed into a garden spot, where the neighbors now co-operate to make a better community.

In a few of the regular gardens, certain days were set aside for the sale of excess vegetables. The profits thus gained, to be kept as a source from which to draw for extra equipment for the garden.

The crop report for the season amounted to $4,532.06 in the school gardens, and $5,055.99 in the victory gardens, making a total of $9,588.05 for all gardens for the season.

The number of children under instruction averaged 1,303 daily.

Early in the season, the management of the school garden activities was transferred from the Division of Physical Education to that of Practical Arts and Vocational Education and will continue under the control of the director of that department of education.

nature study and gardening in the graded schools, washington, d. c.

normal extension work

Ten gardens, covering one and three quarters acres, were cultivated by four hundred boys under three teachers in 1919. The work began in April and was regarded for boys of the sixth grades,

as manual training is for seventh and eighth, viz.: regular school work to which one and a half hours per week are assigned. Summer attendance is voluntary. For this reason at the two largest gardens, Ross and the Ludlow gardens, the experiment was tried of charging a nominal rent, fifteen cents (15c) per month for a plot of 200 square feet. No better proof can be cited of the fact that what people pay for and own they take better care of than that which they get for nothing, than by comparing the attendance at above named gardens with the smaller gardens where no rent was charged. At the Ludlow, 6th and G streets, N. E., the average attendance for the summer was 94.2 per cent.; at the Ross Garden 73 per cent. These gardens were open four days per week. At the Morgan and Force, two small gardens where no charge was made for the use of the land and the gardens were open but one day per week, the attendance was respectively 38 per cent. and 36 per cent.

In addition to the above the schools were repsonsible for 16,203 home gardens, 11,080 in the white schools, 5,123 in the colored. No record of the amount produced in these gardens can be obtained until the appropriation warrants teachers for supervision of the children's home gardens.

This work has always been directed by the Normal School but it is hoped that the schools are on the way toward an organized department of nature study and gardening throughout the entire graded system. A carefully planned course of study has been put into the first four grades by the Director of Primary Instruction. A corps of twelve teachers is systematically at work in the sixth, seventh and eighth grades, visiting every school once in two weeks. An economic trend is given to all of their lessons in the higher grades. The sixth grade course covers the life histories of the common garden insects with methods of control; common rocks and derivative soils of the District of Columbia; soil improvement including water distribution and fertilizers. Birds, the allies of the gardener, make a popular course in the seventh grade. This covers the identification of the common birds of the District, an acquaintance with their calls and habits; making feeding counters and nesting boxes. Trees of the District of Columbia is the eighth grade unit. This covers identification of the city's trees; the way trees grow; their insect inhabitants; difficulties

that city trees contend with and care that the population should give them.

It remains now to provide teachers sufficient to cover the fifth grades and to have a director for the work who can devote all of his time to it. When this is accomplished the Washington school children will have equal advantages with children in other large cities of the United States in becoming acquainted with God's great out-of-doors.

GRAND RAPIDS, MICHIGAN, GARDEN CLUBS

Grace M. Watson, Supervisor

Club work is a practical "back to the home," "made in America" type of education, so Grand Rapids has 73 clubs, in 35 public and 16 parochial schools with a membership of 3,055 children. The directors made 14,672 visits of inspection and gave 48 canning demonstrations. At two canning centers, 134⅓ bushels of vegetables and 12⅞ bushels of fruit were canned by teachers and children.

RICHMOND, VA., JAN. 15th, 1920

Alvin L. Thomas, Director

The school board appropriated funds to employ me as director with six assistants to organize the garden work. I am the principal of one of the schools in the city and the six assistants were regular class room teachers.

We worked out a plan for gardens at the schools where there was ground enough and for gardens at the pupil's homes. At the school gardens the pupils worked with the instructor once and twice a week during school time and were given credit under manual training. During the summer the instructor visited these gardens twice a week while the boys were at work.

The boys were given one-half the produce from their plots in the school gardens. The other half of the produce was sent to the girls' canning clubs at the different schools. Here the girls, under the supervision of a domestic science teacher, canned the produce for use in the Open Air Grades and lunch counters which are operated in the different schools of the city. About a thousand jars of food were canned.

In order to get the boys and girls interested in gardening at home we followed a different plan. Letters were sent home by the

pupils giving the value and need of gardening. Pupils ten years of age who had a garden spot not less than one hundred fifty square feet in area and who promised to look after their gardens all the summer and do most of the work themselves were enrolled in the U. S. S. G. A.

Toward the beginning of May all the gardens were visited by the regular grade teachers and all unsatisfactory ones weeded out. The city was then divided into seven districts and each pupil's home garden was visited every two weeks. During these visits the pupils were instructed as to the care of crops, the preparation of the soil, succession planting, etc.

For this purpose the instructor had a special record card on which he kept his records as to the instructions given, crops harvested, amounts canned, amounts sold, time spent in the garden, etc.

To stimulate the work two exhibits were held in each school, one in June and one in September. The best exhibits from each school were then collected and placed on exhibition in one of the larger stores in the central part of the city. At each of the exhibitsc numerous prizes and blue ribbons were awarded. These exhibits proved to be very interesting and educational both for the pupils and the general public. The prizes were given by various merchants and banks.

The report from Supervisor Clayton F. Palmer of Los Angeles will appear in the May number of The Review which is to be devoted to the Pacific Coast Nature-Study activities.

The Children's Corner

("These papers have been selected from daily school assignments. The papers, Birds' Nests and The Life History of a Moth, were written after continued observation and discussion. A Bird's Christmas came as a spontaneous response after a lesson on feeding birds at the school window.—EDITOR.)

Chester Ward, 7 A Grade, Dec. 22, 1919

A BIRD'S CHRISTMAS

He didn't know it was Christmas of course because he was only a bird and Christmas seemed to him like any other day only colder.

He was hungry but he couldn't find food because it was covered with snow. The same snow that delights the boys and girls.

He flew aimlessly about looking vainly for food until he was so weak that he could fly no more. Then he lit weakly on the window-sill of a big red building. On the other side of the window was a small log covered with something to eat. He hopped over and tasted it. It was suet and seeds.

The good Lord had not forgotten to lead a starving bird to a feast on His birthday.

Elizabeth Ford, 6 B Grade, Nov. 7, 1919

THE LIFE HISTORY OF A MOTH

Tucked away on a broad green leaf of an oak tree was a tiny egg, so small that the eyes of a grown-up person could not see it, but the bright eyes of a child could discover it immediately.

One bright sunshiney Spring day a little worm crawled out of this egg. That was the first time it saw the big world and having satisfied itself it was a good place to live in it started eating the big broad leaf. That is one of the activities of a caterpillar. The others are, eating, growing and resting. It is quite a lazy life don't you think? The common caterpillar must shed its skin seven times before it has reached its full growth. The color of a caterpillar sometimes corresponds to the color of its surroundings. This provides a sort of camouflage to protect the insect from any harm that might come over it.

Now let us suppose our friend, the little caterpillar whom we left eating the green leaf has thrived well during the Summer and, as Winter draws near has prepared to spin his cocoon. It is very interesting to watch this performance. The caterpillar wraps itself

up in silk threads which seems to come from nowhere and aided by dry leaves and small twigs, the cocoon is finished and the contented little caterpillar settles down in its winter quarters.

When Summer comes again and the flowers are peeping forth; a beautiful moth is flying about and this moth was once the creeping crawling caterpillar who lived on the green leaves of the oak tree. Perhaps this is a mother moth, then she will lay her eggs carefully away until next Spring, when the little caterpillar will crawl out and begin life, first a creeping worm, second a cocoon and third the moth.

Ruth Callahan, 7 A Grade, Nov. 17, 1919

BIRDS' NESTS

1—Purpose.
2—Material.
3—Shape.
4—Places.

Examine some birds' nests with me. What wonderful workmanship—yes—but did you ever think of the purpose back of those many hours of painstaking labor? The very same idea prompts these feathered friends to build homes that prompts humans to construct houses.

In Spring the papa bird chooses a plump little wife to help him and together, with soft loving coos and sometimes angry pecks, they build their home. Into it are woven with infinite care strings, twigs, hair, moss,—anything to make it comfortable and substantial. The inside is always softly lined with feathers or hair to keep the babies warm and comfy when they arrive.

The shape of these snug little homes widely differ. Some are small and round signifying that its inhabitants are small and plump, while others are large and rather flat showing that its owners are large and muscular. The perfect little swing downin the orchard belongs to Mr. Oriole and family. Mr. Kingfisher is not so particular in his location and build for he selects a high sandbank and merely makes a hole large enough to shelter him and his family. Little Mrs. Ovenbird builds her nest flat on the ground but hides it so well that you will have considerable trouble in finding it.

Every bird according to his nature has his particular favorites in shape, size, material and location. But no matter how built or

where located his nest is always exactly suited to his own needs and those of his family.

Marguerite Holmes, Dec. 18, 1919

MY LIFE HISTORY (THE HOUSE FLY)

People say I am one of the worst enemies to good health.

My mother laid the eggs on a manure pile. She laid one hundred and twenty eggs. I was in one of them. In a few days my brothers and sisters and myself hatched out little worms or maggots. Here I will leave them but continue about myself.

I began to eat and I ate until I thought I had better rest awhile. Then I changed my skin. I did this several times till at last I thought I ought to have a good long sleep so I changed to a pupa and went to sleep. I slept a few weeks and then came out. My! What a change had come over me. I had three pairs of legs and two pairs of wings and everything so I could fly. I had a fine time flying around. In the fall I went into a house and hid behind pictures for the winter.

In the spring I will come out and lay eggs so, beware!

Wishes

BERNICE RANDALL

When I walk in my garden
  I think I'd like to be
Something very tall and strong
  Like our great linden tree.

And then again I'd like to be
  A shimm'ring butterfly
To rest upon a sweet pink rose
  As I go skimming by.

But when I hear the robin sing
  In the early days of spring
I'd gladly be a little bird
  And sing, and sing, and sing.

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A drawing by Audubon

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Photo by Paul Needham

Peter

TABLE OF CONTENTS

Peter. Wm. P. Alexander - - - - - - 133
The Black Skimmer. Dr. R. W. Shufeldt - - - 136
The Wood Duck - - - - - - - 140
Birds and Topography. John C. Branner - - - 143
A Whippoorwill of New England. Mary A. Quick - - 144
Ages of Birds - - - - - - - - 146
A Graded Course in Bird Study. A. B. Comstock - - 147
An Overnbuilder. A. M. Wenger - - - - - 157
Devices for Bird Attraction. C. C. Leeson - - - 162
The Belted Kingfisher. Henry Klein - - - - 164
Several Bird Notes. G. B. Happ - - - - - 173
Editorial - - - - - - - - 175
The Book Shelf - - - - - - - - 176

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Peter—The Story of a Pet Owl

WILLIAM P. ALEXANDER
Instructor in Farm Nature-Study, Cornell University

Ornithologists would have called him *Otus avio*, but when a Cornell student one day gave me a little gray screech owl that he had found with a broken wing and grievously lacerated breast, I took it home with me and called it simply Peter.

Some person with a gun, and but little common sense had injured him badly, and to save his life seemed for a long while a hopeless undertaking. His injured parts were carefully washed and treated with a powerful antiseptic, a performance attended with divers trying difficulties, for Peter expostulated in a most effective manner with beak, claws and much clapping of his resounding mandibles. For many days he took no food, and we were required to place water down his throat with the aid of a pipette.

He would sit with his feathers fluffed out, huddled up in the corner of his cage, a picture of dejection and pathetic despondency. His nights were usually spent in tearing at his wounded breast and the possibility of its ever healing grew daily less, and we all but gave Peter up for a doomed owl.

Then a surprising thing happened. One morning a large fat mouse that hung in his cage disappeared, and from that time he brightened up, ate regularly and gradually became a well, strong bird again, but his beautiful left wing was useless to him for flight, and Peter's sole means of locomotion was thenceforth, his singularly active feet. He would walk with a most dignified stride, take long bounding leaps or claw his way up the rough cellar wall with the agility of a rodent.

Peter soon became very tame and withal one of the most droll and amusing pets imaginable. He was very cat-like in appearance and in his habits.

His head, with its pair of erectile ear-tufts, large golden eyes with their striking contractile irises, and blinking, nictitating eyelids,

together with the birstle-like whiskers about his beak gave him a most oddly feline-like countenance.

Cat-like too, was his strange manner of hissing his displeasure, his powerful claws and padded feet upon which he would stalk about with a silent stealthy tread.

The plumage of the screech owl is soft and beautiful in the extreme, and Peter was a paragon of finish in the way of clothes. His breast feathers were surprisingly fluffy and protectively colored. To stretch out his uninjured wing afforded constant pleasure, and excited much admiration in those who saw it, for a feathered organ of locomotion could hardly be patterned more astoundingly perfect than was developed in this small bird. Above his eyes were curious little plumose feathers arranged in rows that strongly suggested eyebrows. With his fine erect ear-tufts above, and grotesque short tail below, the disk-like areas around his eyes and neatly folded wings, Peter was a creature to delight the eye whenever he sat, as he often did, by the half hour, droll, wise and stoically immobile as a meditating monk.

To feed Peter became a great problem. He took to raw beef and raisins with but a graceless indifference; but mice were his first and last choice and the objects of his constant longing. To supply him with the delectable rodents required much time and the exercise of considerable contriving. The laboratory assistants and the janitors at the college were pressed into Peter's service, and most of the neighbors were industriously put to work setting traps that his vigorous appetite might be appeased.

One mouse a night and sometimes two kept Peter in good health, but trapping his elusive food caused his master an expenditure of energy greater than would be required to feed a flock of barnyard fowls. When mice at last became too difficult to obtain in serviceable quantities, we began to feed our pet on chopped raw beef. Our first trials were failures.

Owls must regurgitate the indigestable parts of their food such as the hair and bones. Regurgitation has become habit with them, so Peter when fed nothing but meat would eject a portion of what he had eaten from sheer force of habit. We then wrapped his food in cotton, and this method of feeding proved a success. When he ate raisins, he would not take them voluntarily, but swallowed them readily enough when they were offered to him with tweezers.

Peter had several well defined facial expressions that always appeared under certain stimuli. When shown his cage, a look of

recognition came over his features that was very marked, and seemed to say: "Ah! that's where I take my diurnal repose."

He responded to gentle scratching on his head with a most blissful expression. This performance never failed to win his confidence, in fact he solicited this attention it would seem, if we could so interpret the look he always bestowed upon a person who had thus functioned in his behalf. Two other expressions should be mentioned. One that we called "*bluff*" and another that most expressively suggested hate. The first of these was sometimes shown when he was suddenly disturbed while sleeping. He would puff himself up to twice natural size and spread his uninjured wing its full length before him, swaying and hissing the while in a most ferocious manner; he then looked to be a most formidable bird instead of the tiny owl that he was, so small in fact that he could pass thru the meshes of ordinary chicken wire with ease.

Hate he once displayed when a neighbor's cat sprang upon a window ledge and looked into the room where he was sitting. He at once became stiff and rigid, his feathers flattened tight against his small body and his ear-tufts were wholly depressed; a savage glow came into his eyes, the irises opened their widest and he stared fixedly for a few moments in silent fury, then considering himself vanquished by the cat's glowering eyes, he suddenly betook his rage to a neighboring bedroom and hid himself under a bureau.

Besides a great deal of beak clapping, Peter was able to express himself vocally in several different ways. Hissing with the softest sibilance imaginable was his most common method of protesting when disturbed, or if he was suddenly seized he sometimes gave voice to a long emphatic *whoo-oo:* but the sound we liked best to hear was his shivery little song that he uttered a few times, usually just after sunset or in the wee small hours of the morning.

Owls have four toes, and when they perch, two are placed before, and two behind. The strength and grasping power of these toes is truly amazing, and Peter lacked none of the phalangeal vigor that was his by inheritance, for he several times demonstrated the utility of his claw-armed toes on my disturbing hand.

We have had many animals, vertebrate and invertebrate, feathered and furred, wild and domestic for pets, but taken all in all, for general and particular interest, for droll and unusual behavior, and for actual usefulness (he was a better mouser than most cats) Peter stood head and shoulders above them all.

Life History of the Black Skimmer or Scissor-Bill

Dr. R. W. Shufeldt
Washington, D. C.

Over forty-five years ago, I enjoyed my first opportunity to study the Black Skimmer in nature; this was on the Bahama Banks and on the various Florida Cays—localities where the bird formerly occurred in enormous numbers. Particularly was this the case in the winter, as during the warmer months of the year, this species extends its migrations northward along our Atlantic coasts to islands off the shores of New Jersey, and possibly stragglers may even reach somewhat higher latitudes. Audubon, for instance, claims to have seen them to the eastward "as far as the sands of Long Island;" but it is much to be doubted that the Skimmer ever occurs there in these days. I have photographically copied Audubon's plate of this species, and a reproduction of the same is the cover picture of this number of the Nature-Study Review. It gives a very excellent idea of the form and appearance of this truly interesting type, while the description of it by this author is quite unsatisfactory in various respects. For example, he says that the "bill [is] of a rich carmine, inclining to vermilion for about half its length, the rest black;" but nowhere does he state *which half* is black and which half is of the other color. Again, Audubon says: "Feet of the same colour as the base of the bill;" which, from what has gone before, leaves us in doubt as to whether he means that the feet are black or "rich carmine." Now Wilson, the far more accurate describer of birds, tells us in regard to these points, that the "length of the lower mandible [is] four inches and a half; of the upper, three inches and a half; both of a scarlet red, tinged with orange, and ending in black; the lower extremity thin; the upper grooved, so as to receive the edge of the lower; * * * legs and webbed feet, bright scarlet, formed almost exactly like those of a Tern."

The plumage of the Skimmer is largely black and white; and Audubon states that, apart from the white, "the rest of the neck and lower parts in spring and summer of a delicate cream-color." This fact is not mentioned by other writers at hand, while Wilson tells us that the "front, passing down the neck below the eye, throat, breast, and whole lower parts, pure white." Surely it would be worth the while were some good describer of the plumage of birds to compare and correct the various statements of these two

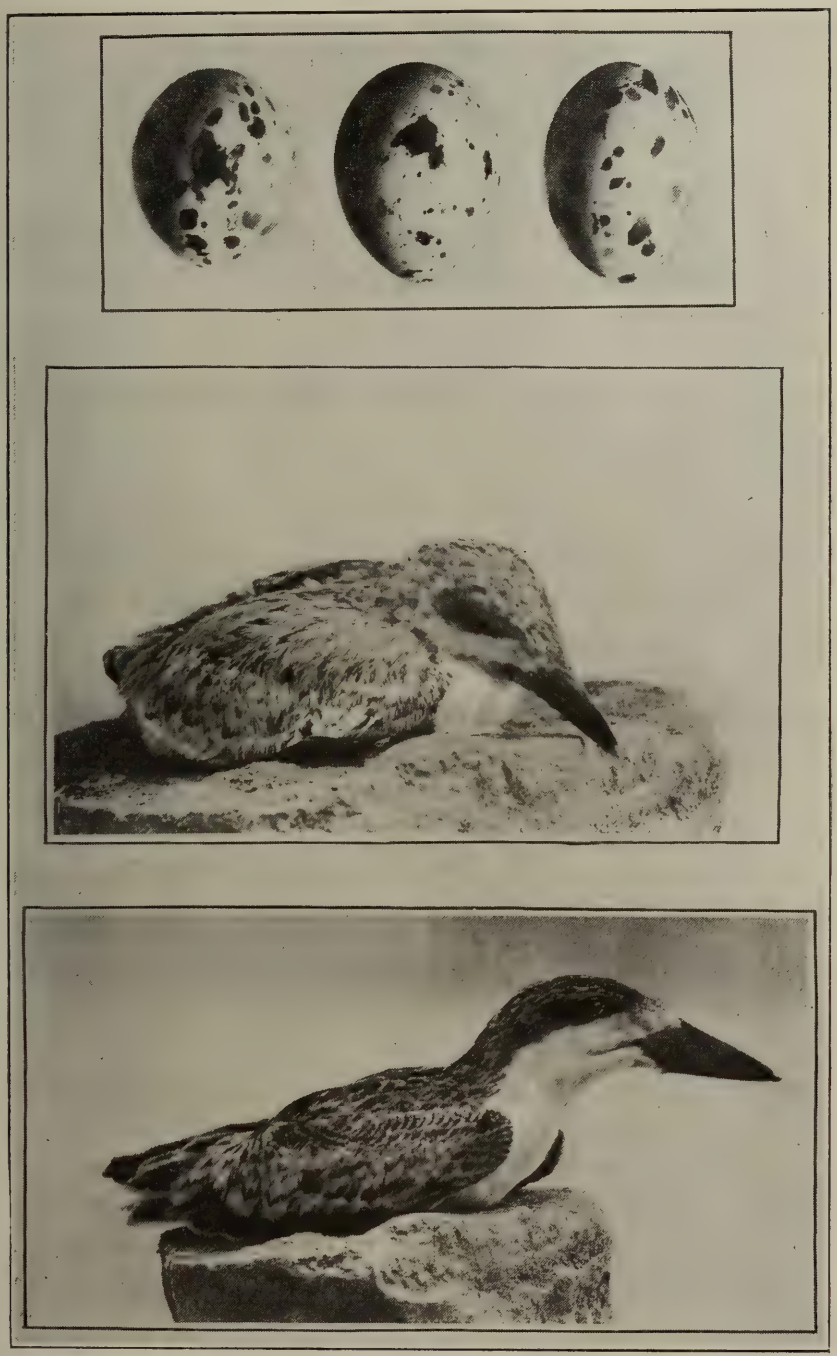

Fig. 1. Adult Black Skimmer in flight After Audubon. See Cover.
Fig. 2. Three eggs of the Skimmer. About one-half natural size
Fig. 3. A young Skimmer, a fortnight or more before it is able to fly
Fig. 4. The subadult Skimmer, a short time before it is able to fly. Note how the bill in this figure and the one n Figure 3 differ from the beak of the adult bird.

prominent ornithological writers, and to let the world have the result in printed form.

It is truly an interesting sight to observe a single Black Skimmer when in pursuit of its food, which consists of certain marine aquatic species that it captures with its curious bill as it skims, in gentle flight, over the surface of the sea or over the smoother waters of bays and coast-inlets. I shall never forget how beautiful they appeared when thus engaged along the shores of the sandy cays of Florida—especially at sunrise or sunset, when their black and white forms were contrasted with the deep blue shades of the water. One can easily imagine any of the long-extinct birds of the genus *Ichthyornis* similarly engaged, as they skimmed over the ancient cretaceous lakes or other waters of the "Kansas beds." Marsh compared the fossil skeletons of these curious birds of a million or more years ago with those of a modern tern; but as it was quite evident that the *teeth in the jaws* of an *Ichthysaurus* were intended to seize its prey with as it skimmed over the surface of the water, just as our Black Skimmers do to-day over existing seas, *Ichthyornis victor*, for example, might be a nearer relative of our Black Skimmer than it was to a tern, as Professor Marsh had supposed. I therefore instituted, some time ago, a comparison of the skeletons of the several forms, which demonstrated the fact that I was correct in this matter. Our Skimmer, however, has no teeth in its bill, any more than has a Loon, which latter is a descendant of a coexistent species of the *Ichthyornis*—that is to say, the various species of *Hesperornis*.

I am indebted to Mr. Edward J. Court, of Washington, D. C., for the loan of eggs of our Black Skimmer; these I have photographed, and the reader will find them reproduced in the plate illustration 2 of the present article. They may be slightly smaller than the originals, which were each of an oval form, with a ground color of white, over which we find blotches of black or umber brow of various sizes, with sometimes dashes of a purplish tint. They are laid on sand bars and formerly in great numbers; and Wilson states that "the nest is a mere hollow, formed in the sand, without any other materials. The female lays three eggs, almost exactly oval, of a clear white, marked with large, round spots of brownish black, and intermixed with others of pale Indian ink. These eggs measure one inch and three-quarters, by one inch and a quarter. Half a bushel and more of eggs has sometimes been collected from

one sand bar within the compass of half an acre. These eggs have something of a fishy taste, but are eaten by many people on the coast."

On one of the sandy cays of the Bahama Banks, early in 1864, I found the Black skimmers breeding in hundreds— almost said thousands—and their eggs could be readily gathered by the basketful. When the birds arose, with their harsh, screaming notes, they appeared like great clouds of black and white birds that dimmed the light of the afternoon sun as they passed 'twixt it and me. The sailors that were along gathered a great many of the eggs, which they carried back for the crew of the gunboat to which I was at that time attached. It is a rare circumstance to see a Scissor-bill alight in the water as do gulls and terns so frequently; but it is truly a beautiful sight to see a whole flock of them come sailing along and alight on the pale sand of an isolated sand bar. *Rhynchops nigra*, which is the scientific name of this species will never be seen again on any of our coasts in such numbers—the gun and egg-taking have accomplished their work!

Many years ago, Mr. William Palmer, of the United States National Museum, kindly loaned me for the purpose of photography a number of young specimens of the Black Skimmer, and two of the results of my work in that field are here reproduced, in that the pictorial side of my sketch of the bird may be complete. These, it will be seen, are of different ages, Figure 3 giving the appearance of the bird when it is very young, and Figure 4 when it is practically in the subadult stage, though still unable to fly. When first hatched, the young Skimmers are light-colored, dappled and streaked in such a way in their downy plumage as to render them very difficult to detect as they lie quietly on the sand. Wilson says: "The young remain for several weeks before they are able to fly; are fed with great assiduity by both parents, and seem to delight in lying with loosened wings flat on the sand, enjoying its invigorating warmth. They breed but once in the season."

These Skimmers never feed except on wing and flying over the surface of the water. They then very adroitly gather up small prawns, shrimp, some insects, but more particularly such fish fry as are there to be seen. The bird uses its beak with remarkable grace and ease, securing its prey without the slightest effort, and swallowing it on the wing. They are also fond of sand fleas and skippers, and remains of these are to be found in the stomachs of recently killed specimens of the bird.

We have but the one species of *Rhynchops* in our avifauna, while other forms occur in South America. When fullgrown, our species has a length of some 19 inches, not including the extra four inches of the closed wings. An old male will weight about 12 ounces, and the female about three ounces less. In the female the tail is white and broadly centered with black—otherwise she quite closely resembles the male. Owing to the peculiar conformation of their beaks, the Skimmers can in no way masticate their food, but swallow it instantly. It will be found that the stomach of the species makes up for this deficiency by being very firm and of dense muscularity.

Wm. Macgillivray, as usual, gives us a brief, illustrated account of the digestive apparatus of this bird at the close of Audubon's account, in the "great work" of the latter.

The Wood Duck

In this number of the NATURE-STUDY REVIEW is included an outline of the Wood Duck which is without question the most highly ornamented of our American birds. This has been done with the hope that an interest in protecting this bird may be aroused and steps be taken for its preservation. Mr. Shields states the case well: "The wood duck is far too beautiful a bird to be killed for food. Its economic value is too small to be worth a moment's consideration. I would as soon think of killing and eating a Baltimore oriole or a scarlet tanager as a wood duck, and I hope to see the day when the latter will be protected all the year round by the laws of all the states in the Union and of all the provinces of Canada."

The following account of the wood duck is taken from that admirable book Game Birds, Wild-Fowl and Shore Birds, by Edward H. Forbush:

This species is the loveliest of all wild-fowl. Even the Mandarin Duck of China is not so strikingly beautiful. The female is a fitting bride for her lord. Her plumage is not so bright, but the colors and patterns are neat and modest, and her form and carriage are remarkably attractive. Nature presents no more delightful sight than a flock of these beautiful birds at play on the surface of

a pellucid woodland stream, their elegant forms floating as lightly as a drifting leaf and mirrored in the element that they love. The display of their wonderful plumage among the flashing lights and deep shadows of such a secluded nook forms a picture, framed by the umbrageous foliage of the forest, that, once seen by the lover of nature, is indelibly imprinted on his memory as one of the episodes of a lifetime. I have taken more pleasure in watching a flock of these exquisite birds in such surroundings that I can imagine any one could take in shooting into the flock. But there are men who will watch a family of Wood Ducks thru the summer, until the young are grown, and then hunt and exterminate them; or who will shoot them ruthlessly in spring—even after the nests are made and the eggs are laid.

Many years ago the Wood Duck was the most abundant of all wild-fowl in many well-wooded regions of the United States. Hundreds flocked along the wooded streams and about the woodland ponds. Even within the past fifty years this splendid Duck has been very numerous in the forested regions of some of the States east of the Mississippi.

The fate of the Wood Duck is determined by its breeding and migration range. This lies mostly within the United States, where, for centuries, spring shooting has been allowed. Had it been able go breed in the far north, where few white men ever go, it would have been better able to maintain itself, or had it bred mainly in southern Canada even, where spring shooting is prohibited and where the law is respected, and had it been able to pass over the United States in its migration without stopping, it might have avoided destruction; but it lives mainly within the United States. It frequents small streams and ponds only a gunshot in width or less, in wooded regions where it is easily ambushed by the hunter, and our people have ruthlessly destroyed this, one of the most beautiful objects of creation, and will yet eradicate it unless laws are enacted and enforced in all the States, protecting it at all times. This bird is better appreciated abroad than here. In Belgium large numbers are reared in captivity, and they are in great demand as ornamental water-fowl. It may be that the bird can be saved from extinction only by rearing it upon preserves and large estates, and retaining enough in confinement each winter to perpetuate the species. It is now (1911) protected by law at all times in New York, Connecticut, Massachusetts, New Hampshire, Vermont and Maine.

Some States do not protect this bird at all; many others allow shooting for a part of the spring. Wood Ducks begin mating in the south in December, January or February, and are mostly mated when they arrive in the north. If all the eastern states would enact laws forbidding spring shooting, and protecting the Wood Duck at all times, a few years would suffice to repopulate the country with this beautiful bird.

In flight the Wood Duck is swift and direct when in the open, but it can penetrate among the many branches of the woods as swiftly and surely as a Ruffed Grouse or a Passenger Pigeon, twisting and turning rapidly in avoiding the many obstacles in its way. It nests usually near the water; but if no hollow tree or stump is to be found near its chosen feeding ground it will find one farther away, in an old orchard, a hollow elm overhanging a farm-house or some old tree by the roadside. I have been informed that the eggs of the Wood Duck are sometimes laid on the ground where no better site can be found, but have never seen one so situated. The height of the nestling site above the ground or water varies from three feet, or even less, to forty or more. The bird is able to so compress her body that she can squeeze into a very small hole, but when the entrance is of a size to accommodate her easily, she appears to fly directly into it, striking the plumage of her breast against the lower edge of the entrance to break the force and speed of her descent.

When the young are hatched they are soon pushed out or fall out, and if the nest is favorably situated they drop upon the water. If the nest is some distance from the water the process of getting the young to it varies with individual birds. I have questioned people who claim to have seen the operation, and am convinced that the mother usually takes the young in her bill and flies with them to the water.

A few nesting boxes put up in the trees about a pond may induce Wood Ducks to nest there. This device is often successful, and I have seen a Wood Duck family that was reared in a nest of this kind. Where they are unmolested they become tame. A family once frequented a small pond within a hundred yards of my home, and a pair bred in a city park several seasons.

The Wood Duck is a surface feeder. Most of its food is obtained in shallow water or on shore. It takes both vegetable and animal food, insects, chestnuts, acorns, etc.

What Some Animals Know About Topography

JOHN C. BRANNER
Professor of Geology, Stanford University

Credit is often claimed for the superior intelligence and scientific attainments of engineers in overcoming problems in the building of roads, railways, and aqueducts across mountainous regions. I have often noticed, though, that animals other than man know a thing or two about such matters. Anyone who has had to travel much with pack-mules or donkeys in hilly or mountainous regions must have noticed that such an animal, when left to himself to climb a long steep hill, knows how to zig-zag so as to get as easy a grade as possible, quite as well as an engineer.

Birds are evidently so far above the surface irregularities of the earth that they are supposed to be quite independent of topography. That independence, however, probably belongs only to very high flying birds. At least I was led to think so by watching the flight of robins on their way south in the fall of 1882 in the South Mountains of Pennsylvania.

In the latter part of the month of October, 1882, I was working on the topography of the mountains along the south side of the Cumberland Valley and thirty or forty miles north of the town of Gettysburg, Pennsylvania. The region was covered by heavy forests, but the trees were already bare of leaves, and the woods were just then full of robins on their way south. In surveying lines several miles in length through the forests I was struck by the fact that the robins were not all flying in the same direction, though they all went in the same general direction at any one point. If I stopped long at one place the robins were all seen to be moving, by their usual short and dilatory flights, toward the south; at another place they were moving toward the southwest; and at still another point they were moving *toward the northeast*. At first the flight toward the northeast puzzled me, for they were clearly not the accidents or individual variations in direction that one may see in the general movements of robins. So at first I concluded that birds sometimes made mistakes just like people. Later I found that the birds knew more about their business than I did, for I learned that where the birds were flying toward the northeast, the gap was always near by, but when they were flying toward the southwest the gap might be either near or far. At first I was much puzzled by these differences, but on climbing to the tops of some of

the mountains I found that the birds did not fly over the tops of the main ridges, but were simply passing through the low gaps in the range. In other words they avoided climbing over the mountains where it was possible to cross them at levels several hundred feet lower.

In my study of the topography thereafter, I found the flight of the robins in that region decidedly helpful in locating gaps in the main ridge, when from my position on the ground, and in heavy forests it was impossible to see the gaps at any considerable distance.

The mountain range through that particular region has a northeast-southwest course, and this bearing explains why some of the robins flew toward the northeast: they were near a gap in that direction. When the nearest gap was to the southwest, the robins flew southwestward; and once in the passes they followed the bottoms of the wind-gaps like living streams.

A Whippoorwill of New England

Mary A. Quick
Ithaca, N. Y.

I strolled in the warm summer twilight along the rocky hillroad watching the sunset glow fade in west over the jutting mountain peaks in the distance. Even the sibilant whirr of the locusts' wings and the subdued chirring of the crickets were hushed for, out of the depths of the woods, came the loud wild call whip-poor-will, whip-poor-will, whip-poor-will! I paused and again the song was rapidly reiterated and it drifted nearer and nearer until it was so close that I could hear a low chuck, chuck which preceded its wild song and I thought as Wordsworth did of the Cuckoo; "Oh Spirit, can I call thee bird or but a wandering voice." It continued singing until I wondered where it found breath for such a rapid and long continued effort. Silence again intervened and then away toward the gloomy forest which loomed up darker than ever, I heard the song repeated wildly sweet, but farther and farther away it floated and dropped into silence. Again to my ears came the chirring of crickets and the whirring of locusts' wings and as if from a dream I awoke to the scene around me and continued my way to the cottage where a light in the window was burning and sought my cot, hoping again to hear that voice which had so strangely stirred me.

I did not have to wait long for in early morning I was awakened by the cry at my window:

"When the faintest flush of morning
Overtints the distant hills,
If you waken, if you listen
You may hear the whip-poor-will,
Like an echo from the darkness
Strangely wild across the glen
Sound the notes of his finale
And the woods are still again."

In looking out I saw him drift by like a shadow and with absolute silence, his soft plumage making his flight as noiseless as a screech owl's. His course also was low and wavering like an owl's and as a matter of fact he is often taken for one of that family. As Chapman remarks, "the silence with which he rises in front of one's face and flies away is fully as startling as the overwhelming whirr of a grouse's wings."

Although I have never seen this bird in the light of day my general impression of it is a mottled, ragged dark brown bird with white tips on the outer tail feathers which are conspicuous during flight. Naturalists who have seen this bird describe him as queer looking with front toes tied together by a kind of webbing and almost no hind toes at all. His mouth, too is almost as odd as his toes, the beak being short and depressed and the gape enormous, opening from ear to ear and bordered at the corners by recurved bristles. The plumage is blended brownish with brownish gray, the back flecked with orcherous and buffy. Across the breast is a white band and the tail has broad white flash color only seen during flight.

The food of the whip-poor-wills consists entirely of night flying insects principally moths and beetles. Mr. Eaton has taken 36 full grown moths from the stomach of a single bird which was killed early in the evening, indicating that within an hour and a half he had killed and devoured these full grown moths, each one of which contained hundreds of eggs. Thus it is evident that the whip-poor-will is of untold value to the forester.

The nest of whip-poor-will or rather its pair of eggs, for it makes no nest, is found beneath the dense low hanging foliage of the undergrowth in the forest. The eggs are two in number, dull white in color with spots and blotches of brown, drab, and lavender.

The whip-poor-will prefers the wilder swamps, gulleys and hillsides, to a more settled district and it was in such a location that

my friend the New England whip-poor-will lived. The bird tho seldom seen even by nature lovers or the country people who live near its favorite haunts is well known to the inhabitants of the state. It is one of the few birds that can be surely recognized by its voice even tho the listener has never heard it before and knows it only by name. Many times after my first meeting with the whippoor-will I stood on the porch and whistled forth my best imitation of his song into the fast falling night and from his retreat in the shady forest on the slopes of the glen he would silently come to the bidding call. First his voice sounding far away and then suddenly near me. Not a sound of his coming could be heard but occasionally his low wavering flight was mirrored against the evening sky. After finding there was nothing for him to come to, he would return again to his retreat for very soon his voice would be heard from the distant woodland.

Some people call the song of this night bird mournful and I have heard of the bird being shot because the inhabitants of a house could not bear its doleful and boding cry, as they were pleased to consider it. To my ears it is sweetest music,

> For what are the voices of birds
> Ay, and of beast, but words—our words
> Only so much more sweet.

Often in fancy I have heard his thrilling cry and the lines written by Milton in part of Il Penseroso drift thru my mind:

> Sweet bird, that shunn'st the noise of folly,
> Most musical, most melancholy
> Thee, chantress, oft, the woods among
> I woo, to hear thy even song;
> And missing thee, I walk unseen
> On the dry smooth-shaven green
> To behold the wandering moon.

Ages of Birds

Ravens have been known to live to be 69 years old, nightingales 25, skylarks 24, goldfinches 23, canaries 20, the American robin 13, an eagle-owl 68, a gray parrot 93, a sulphur-crested cockatoo 81, an amazon 102, a white-headed or Egyptian vulture 118, a golden eagle 104, pelicans 32, common herons 22, a black stork 30, a mute swan 70, a domestic goose (authority somewhat doubtful) 80, wild ducks 29, doves and pigeons from 23 to 40 years, herring-gulls 44, ostriches 35, cranes 50.

Suggestions for A Graded Course in Bird Study

Anna Botsford Comstock

It is difficult to make a hard and fast scheme for grading bird study, so much depends upon the environment of the school and of the homes of the pupils and upon the amount of interest shown by the teachers in the work. However, the one chief thing to make the work successful is to plan for plenty of school room work that will stimulate field work and personal observation on the part of the pupils. This I have found to be best accomplished in all grades even up to University students by coloring the outlines of birds, using for copy some standard work like the Book of Birds published by the National Geographic Magazine or the plates in the portfolio of The Birds of New York to be obtained from the New York State Museum at Albany, or the Bird Guides by Reed or any other book or chart showing birds in their true or approximate colors.

As soon as the picture of the bird is finished there should be given an account of the bird's habits which the pupils should learn. The pictures and the subject matter should be reviewed frequently. Coloring these outlines is very attractive work for most pupils and by doing it they get acquainted with the bird's appearance in detail and thus are able to recognize it at once when they see it out of doors, and this adds greatly to the interest and profit to be gained by field trips or by individual field observation.

These outlines when colored either with crayon or water-color may be used in many ways that will make the work of perennial interest.

In the suggestions which follow for grading bird study there is nothing hard and fast. Almost any part of the work given may be satisfactorily transferred to an adjacent grade. The teacher should use any and every device to accomplish the end in view and that is to get the greatest number of pupils interested in bird life and preservation.

KINDERGARTEN AND FIRST GRADE

The little child, at least, must while learning develop along the line of his natural interests. What are these? Eating, playing, sleeping, clothing, his home and family. He is interested in what other children do and have in these particulars and he is also interested in animals and birds, in so far as their experiences touch his

own. Therefore we must appeal to the small child by showing him how a bird lives and how it is fitted to live just that way, in order to arouse the right kind of interest in bird life. This is another of the anomalies discovered through practical experience. The anatomy, physiology and ecology of the bird are taught to the grown-up student after he has gained a somewhat wide knowledge of bird species and habits. However, the writer has taught little children about birds and she discovered their natural interests in them and was astonished to find how much of a bird's adaptations and habits the child of six just naturally observes and comprehends. As a matter of fact the children teach themselves with only a little helpful guidance.

The first thing a child notices in a bird is that it can fly and usually he tries flapping his arms in imitation of wings thus attempting to fly also. Thus he is naturally interested in the bird's wings with the overlapping feathers that help the bird to push itself thru the air. The following jingle is the bird's explanation:

Feathers have I on my fingers,
Just like a feather fan.
I can shut my fans together,
But when I need, I can
Open wide and fan the air
So hard, I fly 'most anywhere.

The study of the bird's wing leads naturally to the observation of the other feathers and therefore the bird's clothing. The fluff at the base of the breast feathers and the down are manifestly "underwear" and the outside smooth, overlapping feathers constitute the bird's coat or "makintosh." The handsome plumage shows another use for feathers and that is to make the bird beautiful.

Our next consideration is naturally what and how a bird eats and how it finds its food. The canary eats seeds, the hen eats seeds and insects also; the robin pulls out earthworms from the soil, the duck finds its food on the water weeds, the kingfisher catches fish, etc. The hen has a horny beak to enable her to pick things out of the soil, the duck has a boad flat beak to seize and strain the food out of the water, the swallow has a broad beak which serves to help keep its mouth wide open so that it can swoop in insects while it is flying. While observing the beak it is natural to see the tongue, the nostrils, and the eyes of the bird and in some cases the ears. Thus a child comes to know that the bird has senses like his own.

The feet may be looked at next; biddy has strong feet for scratching the earth so that she can find food; the duck's feet are webbed so that they may be used for paddles; the woodpecker has two toes extending forward and two backward to enable it to hold on firmly to the bark of a tree. We notice that most of the birds except those that have feet for paddling have their toes and claws fitted for perching on twigs or branches.

Having thus seen the simpler things about a bird's form we relate these to the bird's activities. A bird flies. Why? Where? We find the reasons in the nest in the top of the tree, the getting of food, the going south when the land is covered with snow and there is no food left; all these should be made topics of interesting stories. The bird eats; What? Where does it find its food? It sleeps; where? How does it go to bed? How does it look while asleep? The bird says,

> "When I sleepy get, I fluff my feathers out and doze;
> And underneath my downy plumes I hide my little toes;
> And underneath my little wing, I tuck my little head;
> I look just like a fuzzy ball when I am safe in bed."

The bird has a nest for its babies; where is it placed? Of what is it made? What tools does the bird use in making the nest? The mother bird lays eggs and sits on them to keep them warm; how do the young birds look? The chick, the duckling, and the gosling are clothed with down, have their eyes open and are active, ready to follow their mothers. The young robin is bare and has to be kept warm under the mother's wings and have food brought to it until it grows large enough to develop feathers of its own. The parent birds give care to their young and protect them fromenemies and from the storms.

The birds sing and call; and even the youngest pupil understands that thus the birds talk to each other. Ask them to listen to all that the birds say and try to understand. With no instruction from her elders, the writer as a child understood a dozen different things the hens said to each other and almost as many said by the canary.

Birds are clean and give themselves care. They take baths in the water; they also take sun and dust baths. They preen their feathers; the hen and the duck may be observed oiling their feathers

The teacher may ask "How can I be sure that all these things may be observed in the kindergarten and first grade?" The answer is simple. At one time or another, have a hen or a pair of bantams, a duckling or gosling ,a pigeon and a canary in the school room for a few days. An ordinary crate may be made into a house for the hen or duck or pigeon by putting slats an inch or so apart across the open side. If you are in the city you can get these birds alive in the market; if you are in the country you can borrow them from some farmer. A canary may also be borrowed in its cage for a few days. One of these feathered visitors present in the school room will be the center of attraction. Talk to the children about the birds, not as if you were teaching, but simply as if teacher and pupils were equally interested. The birds should be fed and given water and taken care of in a proper manner in the presence of the pupils. There should be a perch available for the hen and the pigeon. Instead of a crate, a cage with wire netting is more desirable since it allows more constant observation of the bird.

SECOND GRADE

This is the time to stimulate interest in the children for birds in general. I know of no better way of accomplishing this than by reading to them from the Burgess Bird Book for Children. Thornton Burgess knows how to interest children in any subject and there are many grown people who read his bedtime stories for their own amusement; while they are fanciful and fable like yet the author is careful to represent truthfully the habits and activities of birds and animals. His bird book is beautifully illustrated with Louis Fuertes' paintings which fact is a great help to the teacher. As each story is read the pupils should have before them pictures of the birds. The teacher may color the outlines herself or she may use colored pictures. In any case the pupils should afterwards have outlines of one or more of the birds which they should color as best they can with crayons. If this exercise is successful there will be a call on the part of the children for the same story over and over. There are interesting bird stories by other authors that may be read also. At the end of the year the pupils should have a definite idea of the places where many of our common birds may be found and a knowledge of their ways and their nesting habits.

Meanwhile the pupils should be encouraged to observe birds and talk about all they see. This is a very important part of the work. Especially encourage reports about the nesting habits of those birds that build near our dwellings, always impressing upon the children the danger of driving the birds away by tampering with the eggs or nests.

Impromptu plays based upon the Burgess stories or upon the observed habits of the robin, will add greatly to the vitality of the work.

THIRD GRADE

The activities of this year may profitably center around the feeding of birds in winter and the special event of the year should be providing a bird Christmas tree. To make this work successful there should be a feeding station near the school house where the pupils may see it from the windows. If it were possible for any of the pupils to put up suet on the trees about their homes and put out tables with sunflower seeds and other bird food much interest would be added.

For busy work the pupils should color bird outlines with crayons and for these the most common and familiar birds should be chosen. In this way at least fifteen birds should be learned well enough to be recognized when seen.

Stories should be read concerning the birds studied especially stories of the winter experiences of those that go southward.

FOURTH GRADE

The plan of this year's work should be to promote an actual acquaintance on the part of the pupils with at least thirty common birds. The schoolroom work should consist of coloring bird outlines and talks about the birds which the pupils have observed out of doors. One practical way of accomplishing this work is to let each pupil make a calendar for each month, each page of which should be about 9 x 12 inches and may be made of heavy wrapping paper. Let the pupil find some picture appropriate to the month to paste at the top of the sheet then have him color outlines of birds which may be seen that month; then he should cut them out and paste them on the sheet. There should be three or four birds for each month. The folllwing are suggested:

September: Redstart, wood thrush, wood pewee, humming bird.

October: Phœbe, catbird, wren, scarlet tanager.

November: Kingfisher, redwing blackbird, meadow lark.
December: Junco, horned lark, snowflake, cardinal.
January: Crow, English sparrow, bluejay, screech owl.
February: Downy, chickadee, nuthatch, brown creeper.
March: Robin, bluebird, song sparrow, waxwing.
April: The swallows, purple finch, sapsucker, towhee.
May: Kingbird, oriole, rose-breasted grosbeak, bobolink.
June: Red eyed vireo, veery, indigo bunting, goldfinch.

In the spring there should also be kept in each room a calendar of the robin's nesting habits. Each pair under observation whether at the homes of the pupils or in school grounds should have a separate set of observations which should be recorded on the calendar by the teacher and which should include the following points: 1. The date of beginning the nest; 2. The sight and material of the nest; 3. Describe the building. 4. The number and color of the eggs; 5. Actions of birds while incubating; 6. Date of hatching the first nestling; 7. Description of nestling and its actions; 8. The feeding of the nestling; 9. Date of young robins leaving the nest; 10. Description of the young robins.

Another very interesting exercise for fourth grade is collecting nests known to be made by certain bird species; mount these on cardboard with the colored outline of the bird that made it and a short written account of the bird's habits. (See p. 157).

FIFTH GRADE

The object of this year's work should be a wider knowledge of bird species and their habits. Early in the year the teacher should give frequent practice in drilling the children how to see a bird. She should give them first a scheme for looking at a bird, in the following order: general color, color of back, wings, wing bars, tail, top of head, eye streak, chin, breast and under parts. The drill may be given by holding up a colored picture of a bird and let the pupils note the colors in this order giving plenty of time at first; later the time should be shortened until only a momentary glimpse is given. This exercise is of the greatest use in training the pupils to note the color and markings of a bird on the wing or in a tree. The exercise should not exceed five or ten minutes in length.

The activities of the year should include a bird club at the meetings of which among other things there should be discussed the following topics: The enemies of birds. How to circumvent the

cat. How to make a place attractive to birds. Should the red squirrel be considered a dangerous enemy of birds?

During the winter much attention should be given to the location, collecting and the determining of the empty nests.

A very important part of this year's work should be the writing of little stories of migrating birds which should include something descriptive of the country where the bird spends the winter, and a map of its migrations. This correlates the bird work with English, geography and drawing in a most interesting manner. An outline map of North and South America may be traced by the pupil from his geography and the northern and southern limits of the bird's migration be indicated with a blue pencil. The story may be very simple; the very interesting readers supplementary to geography should be used to give the pupil a picture of the land where the bird winters.

As soon as the birds are observed after the return in the spring, the pupils should consult the bird books and make note of the places where they have spent the winter.

Much attention should be given to stimulation of observation of birds out of doors. There should be kept in each room a bird calendar. To make this in the most interesting form for this grade it should be illustrated with colored pictures of birds. This is best done by using large sheets of cardboard with the record of the birds observed, the date, and the locality, the name of the observer at the center and the illustrations along the sides. The pupils should make the illustrations by coloring outlines of the birds which should be cut out and pasted on in appropriate places. Those outlines which are most skillfully colored should be chosen for this and thus create competition in doing work well.

SIXTH GRADE

The bird work of this year should be as much as possible in the field. Each pupil should be provided with a field notebook which may be a special one designed for this purpose or may be one of his own making. In any case they should include a plan for the following observations on each bird:

Date .....

Name of bird .....

1. Where is the bird seen: Woods, border of woods, bushes, open field, trees or bushes along fences, roadside, border of stream, marsh, pond or lake, garden, orchard, about buildings.

2. Compare the size of the bird with that of the crow, the robin, or the English sparrow.

3. Its most striking colors are: Gray, slate, brown, chestnut, black, white, blue, red, yellow, orange, green, olive.

4. Does it show flash colors when flying? If so, where and what color? Wing, rump, tail, under tail.

5. In action is it: Slow and quiet or active and nervous?

6. Does it occur alone or in a flock?

7. In flying does it go: Straight and swift. Dart about. Up and down, wave-like. Flap the wings constantly. Sail or soar with wings steady. Flap the wings and then sail?

8. Describe its song or call note? Where does it sit when singing? Does it sing while flying?

For Closer Observation

9. Colors and markings of: Breast, wings, tail, top of head, eye streak, back.

10. Is the bill: Slender and long, short and thick, medium, curved, hooked?

11. Is the tail: Forked, notched, square, rounded?

Following each page for field observations should be a page to be filled out from books of reference if the field observations fail to cover the points. This work may be done in the school room.

12. What is the food of the bird and how obtained?

13. Where does the bird spend the winter?

14. Describe the nest, where placed, how far from the ground, how supported, of what material is the outside made, how lined? The color and number of eggs.

15. How are the young fed and cared for? The colors of plumage of the young birds.

17. Is this bird beneficial to us, and if so, how and why?

The work should begin promptly in September with observation on migrants and dates for the departure of our summer residents. A bird census of a limited area (not exceeding two or three acres), carried on for the whole year will add greatly to the interest. This area, to be ideal should include woods, fields, fencerows, and a stream; but any place frequented by birds will do. Parks in towns, school grounds, certain shaded streets will do if nothing better is available. The census should include permanent residents, summer and winter residents and migrants.

During the winter when frequent observation is impracticable the time should be given to the study of bird families. The flycatchers, vireos, swallows, thrushes, sparrows, and wrens should be studied. As far as possible, outlines of the members of each family should be painted in water colors. A discussion of one of these families is excellent material for an exercise in English composition.

In the spring there should be prizes or honors given to those seeing the greatest number of returning and migrating birds. There should also be prizes or honors given to those who saw them first. The rules for the competition should be, first, a description of the bird seen, sufficiently full for identification must be given; second, the locality where seen and the action of the bird described; third, it must be reported as soon as possible afterwards. There should be an umpire appointed; some one who knows the birds of the region should be chosen so that he will be able to decide upon difficult points. There should also be kept a school calendar which will show the results of the competition day by day.

An active bird club with short sessions once a week at school will stimulate the field observations greatly.

SEVENTH GRADE

The keynote of the work of this year should be the economic value of birds and their protection. This is the year in most schools when manual training is begun and the making of bird houses and feeding tables should be a part of it. There should be intelligent study put upon the construction of bird houses. The habits of each bird species should be known in order to make a nesting box for it that will be practical. After the boxes have been constructed they should be put up in proper places and at proper heights from the ground.

Feeding tables and bird fountains should be designed so that the birds may frequent them in safety. Cats are learning that feeding stations and bird fountains placed low upon the ground are excellent hunting grounds for them. Barbed wire and wire netting may be used to ward off the cats to some degree.

Bird Lore suggests the following competitions with or without prizes for: 1. The greatest number of bird houses for different species of birds. 2. The school or the room having the largest number of clippings in a birds' scrap book. 3. The best method of

protecting feeding tables from cats.

To awaken interest in the economic value of birds the following divisions into topics is suggested:

The bird friends of the garden.

The birds feeding upon the insects that attack forest trees.

The birds that protect shade trees.

The good work of the birds in orchards.

The bird friends of the meadows and planted crops.

In connection with these topics there should be exhibits, the simplest of which would consist of colored outlines of the birds in water color mounted together for each group. A valuable addition to the exhibit would be a short description of what each bird does and a collection of insects, or their pictures which it destroys.

The birds which do damage should also be studied. There might be a debate on the following topics:

Does the crow do as much good as harm to the farmer?

Do the robins and catbirds do enough good to compensate for the fruit which they eat?

Do the insects destroyed by the English sparrows thru feeding their nestlings compensate for the damage they do in other respects?

To keep the year's work closely connected with field observation, the wood warblers may be studied. This should be regular, weekly work during the year. Outlines of the birds should be colored and a study of their habits be made so as to be ready for profitable observation of the birds during the short time that most of them remain with us during the spring migration.

EIGHTH GRADE

The game birds, the laws for their protection and bird reservations and sanctuaries should be given attention in the eighth grade and in Junior High School. In connection with the game birds, the hawks and owls their natural enemies should be studied.

At least twenty-five or thirty game birds should be learned by the pupils so that they may be readily identified. The best method of accomplishing this is to color the outlines from the very excellent colored pictures now available; this should be done at the rate of at least one per week and should include a study of the bird's habits. Tables for identification which should include males and females and the places where they would naturally be seen

The Belted Kingfisher

From
The Bird Notebooks
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The Whippoorwill

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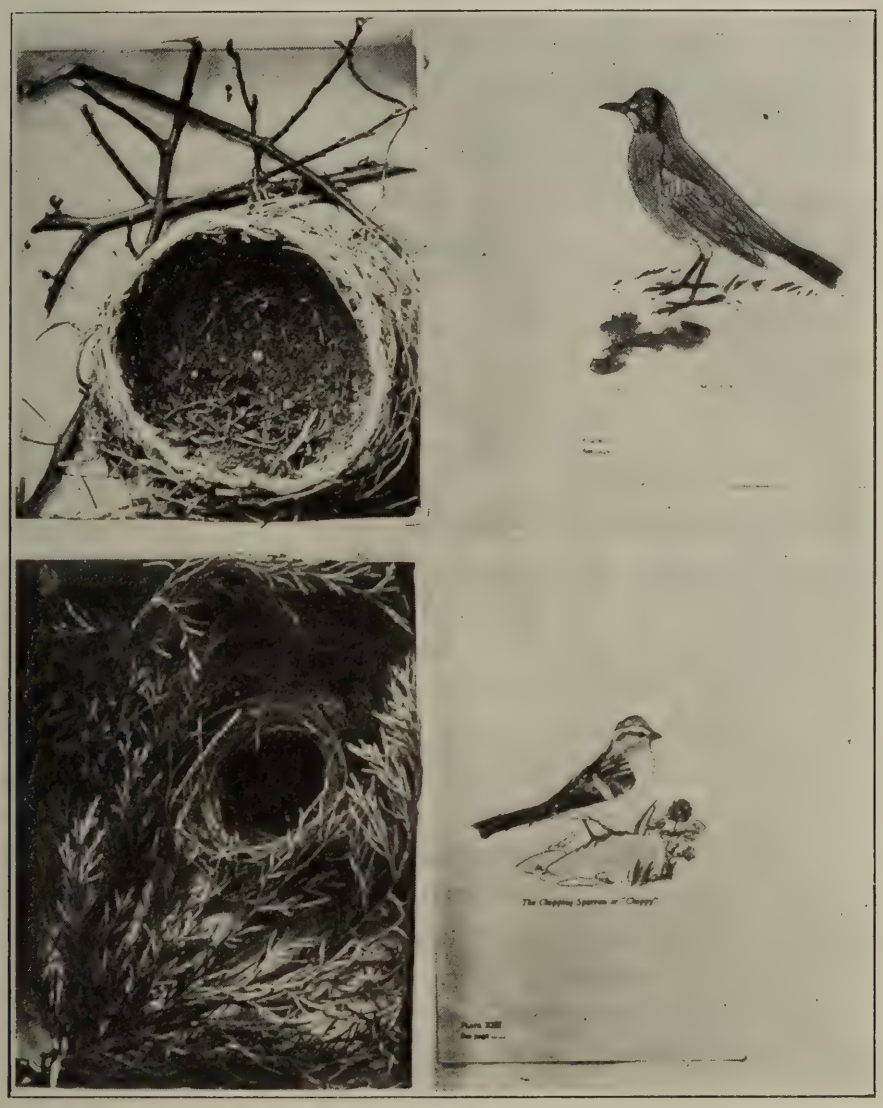


Mr. Alfred Emerson, Jr., devised the following plan for teaching third and fourth grade children the habits of common birds. Each pupil gathered one or more nests and mounted each one in a collar box. This box is mounted on stiff cardboard and beside it a colored outline of the species of birds that built it. On the same card was the story written by the child covering the following points. 1. Name of bird; 2. In what kind of tree or bush and how far from the ground was the nest; 3. Of what was it made; 4. With what was it lined. 5. Where in the tree and how far from the ground was the nest placed; 6. The measure of the width and depth of the nest; 7. The color, the number of eggs laid by this bird and the time of nesting.

should be made by the pupils. These tables may not be of any practical use but making them will serve to make the matter clear in the pupil's minds.

The legislatures of all our states have passed game laws, and digests of these may be obtained by applying to the proper authorities at the state capitol. The U. S. game laws may be obtained from the U. S. Biological Survey; a description of the bird sanctuaries in our country may be obtained there also. The study of the game laws and the bird sanctuaries are very closely correlated with the work in elementary forestry which is also properly eighth grade work.

An Ovenbuilder

ADELINE M. WENGER
Tenefly, N. J.

Nature, the handmaid of God Almighty, doth nothing but with good advice, if we make researches into the true reason of things.—JAMES HOWELL.

With a feeling of the truth expressed in the above quotation, I cannot help but combine with a citation of facts regarding the little warbler known by the common names of Ovenbird, Golden-crowned Warbler, Wood Wagtail, Wagtail Warbler, Land Kickup, Crescendo Chicken, and a few other variations of these names, a bit of which I shall call a "sermonette" for want of a better name.

If the year is still in early May, you may see our feathered friend walking daintily about your garden. He will not remain with you long,—a week will perhaps suffice for him to look about with an alert air, as if making up his mind as to the lady of his choice, whom he will follow to and woo in a quiet woodland of hickory, oak and beech, where ferns grow along the banks bordering and sloping toward a stream, or preferably a high, dry spot thickly carpeted with fallen leaves. There you shall have an opportunity of witnessing that this little bird "doth nothing except with good advice."

As you enter this domain of Nature's creatures, take with you an open mind and heart,—both are needed. You are then ready to receive instruction, patient to wait for it, and ready, when it comes, to mediate upon its meaning.

Perhaps you will first become aware of the presence of the bird you are seeking by a call, at first loud and seemingly close at hand, then repeated from a distance, "Teach! Teacher! Teacher! Teacher!

Teacher! Teacher!" gaining in rapidity and crescendo as the call advances an indefinite number of times. Someone has interpreted it as "Teach us!" and still another as "I see! I see!"

Whichever words you may choose to substitute, of this I am certain,—having once heard the call you will never confuse it with that of any other bird. Personally, I like to think of all three versions,—the cry of "Teacher! Teacher!" being a persistent demand for some one to point out the path of duty, that of "Teach us! Teach us!" a pleading for the knowledge necessary to follow that path, and the "I see!" I see! designating that the way is clear and the path will be followed.

Consider the clothes worn, the home that is built, the markings of the eggs, the rearing of the young, the food gathered, and you will surely see that the prayer for guidance has not been unanswered.

You are now curious to see the author of these persistent strains. Again patience is necessary. Quietly moving in the direction from which the last call has come, you may find, by looking sharply, a bird about half as large as a robin, or a shade smaller than the English Sparrow, walking up and down a limb, and stopping now and then to throw back his golden-crowned head to repeat his demand. You will, of course, see the dark streaks on the white of his breast and sides, and the flesh color of his legs. It would take a very sharp eye to catch a glimpse of the yellow tinge to the under wing coverts, as he flies from his perch to the ground. There, as he walks daintily among the leaves, bobbing his head in a peculiar fashion, and stopping now and then to scratch away the leaves to find a hidden larva, an insect, or perhaps an earthworm, you will have a good opportunity to study the characteristic colorings of the upper portions of his body. The uniform olive green of his back, the dull orange or golden crown extending in a broad stripe over his head and bordered on each side by a narrow black stripe which reaches backward from the brown bill, all blend so well with his surroundings that one must watch closely or he will seem to melt from sight. So we see that in obedience to the instructions received from the "Teacher" upon whom he calls so often, this little bird that Burroughs describes as "by far the prettiest pedestrian in the woods," has donned a suit of modest blending colors to afford himself protection in his environment.

He seems not to object to your quiet watchings, but goes about his search in leisurely fashion. As you watch, you may question,

"Where is the home?" Perhaps it is within your immediate range of vision. If this be true, your little friend among the leaves may only be pretending an air of unconcern.

Those who have been fortunate enough to find the nest, which resembles a Dutch oven in form, have told us much that is of interest. Nothing that safeguards the family is overlooked, as those who have hunted almost in vain, will agree. The dome-shaped framework, erected by the joint labors of male and female, is often placed over a little depression in the ground, near some fallen log, low bushes, or other sheltered spot among the leaves. Within two days it is completed and is found to consist of such materials as dead grass, weed stems, heads of grass, grapevine bark, and strips of chestnut bark. It is now ready for its lining of dead and decayed leaf stems, leaves of chestnut, oak, beech, hickory, cherry and dogwood, and sometimes moss and small dead twigs. An additional lining of grasses, blossom stalks, and long horsehairs makes a soft bed for the eggs and nestlings. Sometimes, also, an interlining of grass and weed stems is found. The outer side is ingeniously concealed by grass, dry leaves, and sometimes overgrowing vines and wild flowers. The entrance, opening on the lower side, is intended to be known only by the owners of the nest. No wonder the devoted parents feel that their nestlings will be safe in this hidden retreat!

May we not pause a moment, again to reflect upon the wisdom of this bird, gained by implicit obedience to the guidance offered in answer to its call?

Dr. T. M. Brewer found a nest in Hingham, Mass., which measured six inches in diameter and 2½″ in depth. The cup had a diameter of 3½″ and a depth of 2″. This being very large for the size of the bird, he explained it as being probably due to the shape of the cavity into which it was sunk. Other nests have been found to consist entirely of pine needles. The nests are some times completed several days before the eggs are laid. In the vicinity of New York City they are usually completed by the middle of May, and since young have been seen to be fed as late as August, it is believed that at least two broods perhaps three, are reared each year.

The eggs are usually five in number, sometimes there are but four, and less often we find six. They are a creamy white, spotted with reddish brown, and faint lilac. One observer writes that both sexes incubate. Frequently the cowbird finds her way to the nest,

deposits from two to five eggs, leaving them to be hatched and the young to be cared for by the faithful warblers.

The young nestlings remain with the parents and are fed by them until they are fully grown. Should you by accident or intention locate the nest, the frightened mother will feign disablement of some kind, flutter close to you, drag herself along the ground away from the nest, and utter piteous cries to distract your attention. The male will also show his intense excitement by darting among the bushes in a nervous, bewildered fashion, until you retreat.

The following accounts of young nestlings are too interesting to pass by:

Florence Merriam writes, in her book, "Birds through an Opera Glass," of three eggs that she had found hatched, "Such absurd looking nestlings! They seemed all mouth and eyeball! Small red appendages answered for wings, and tufts of gray down on the skin did for a coat of feathers. Even when feebly throwing up their heads and opening their big yellow throats for worms, the birds' eyes were closed so fast that they had an uncanny appearance."

Again she writes, "On June 11th, I found a family of full grown young being fed in the branches of a maple-tree. The same day I found a nest full of eggs. June 12th three of these eggs hatched, and I found a nest of young a quarter grown. Jun 13th, I found the family I have just described, well out of the nest. These could hardly have been first and second broods, as they were in all stages of development."

The plumage of the male and female is much alike in spring. The male has a brighter crown, while the famale is more widely tipped with brownish. The young nestlings are a bright cinnamon brown above, streaked with black, the breast and sides are a paler brown and faintly streaked with black, while the underparts are white, and the wing coverts black tipped with rusty. In fall the adults and young resemble each other closely.

Giving closer attention to the bill you will find that it is of the long slender type possessed by warblers, of value in procuring its chief diet of insect food. You may have seen the bird pick up food from among the leaves carpeting the floor of the woodland. It shows great preference for birch plant-lice and larvæ, especially the hairy caterpillars of the Gypsy Moth so destructive during April, May and June. But its diet also includes cankerworms and other

insect pests found in orchards near woods, flies, crickets, spiders and earthworms. It sometimes indulges in a little seed, and has been known to fly to homes in the woodland, for crumbs.

You will surely be interested in the family connections and distribution of this interesting bird. It is classed with the group of American Wood Warblers, known as Mniotiltidæ, which forms next to the largest family of our native birds. There are about 60 representatives of the family in North America, nearly all of them small, abundant, widely distributed, migratory, and insectivorous. Our representative is more distinctly a "ground warbler" and larger than the average.

In the vicinity of New York City and northward, we are apt to find the Golden-crowned Warblers from early May to September, sometimes in October. During the spring migrations they are numerous from Texas and Florida to Wisconsin. They are seen in Texas in early April and before the middle of May have reached Wisconsin.

The breeding range reaches over eastern North America northward to Hudson Bay and Alaska, west to Kansas (Nettie Blanchan reports them west to the Pacific Slope), South to the Ohio Valley and Virginia, and in the higher regions of the Carolinas. They are said to also breed in the Bahamas.

During the fall migrations they have been seen in Texas as early as September 20th, remaining until October 25th. Some travel southward to Central America, while others spend the winter in southern Louisiana, southern Florida, and the West Indies.

Like all warblers, when not nesting, they are seen in parties, and they migrate at night. When crossing large bodies of water, they are often brought in contact with storms with which they are ill-prepared to buffet. During cloudy and foggy nights they lose their bearings, descend from the heights at which they have been migrating, and many blindly strike against lighthouses, fall, and perish in the water.

There are two song periods, the first beginning in early May and becoming less frequent toward the end of June; the second occurring in August, but transient and irregular.

You have become familiar with the song that is sung so vehemently while the bird rests on a branch, and perhaps you have heard its sharp "chick" or "smack", which is its note of alarm. But until you have listened to its flight song, you cannot fully

appreciate the extent to which this warbler can open up his whole bird soul to an outpouring of gratitude and love. This song, which John Burroughs describes as "clear, ringing copious, rivalling the gold finch's in vivacity, and the linnet's in melody," is heard oftenest during the mating season and at the hour of twilight, though it has been heard repeatedly in the morning, at noonday, and in the afternoon.

Ernest S. Thompson, in writing of this song, says, "The ovenbird, at certain seasons of the year, rises into the air, far above the tops of the forest trees, and as he floats on quivering wing, pours forth a loud, sweet, lark-like song—a song full of variety and tenderness, and so prolonged and powerful that one wonders indeed if so small a throat can really be the source of that volume of sweet sound."

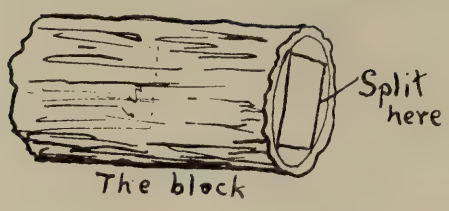
Shall not we human beings, who class ourselves as of a higher order of beings than birds, take to heart the lessons taught by these songs? May we not, too, in like manner, open our souls to receive the gift of wisdom from the Giver Above? And then may we not go on our way to our tasks with the confidence that the guidance we are seeking will be given? Then, when the day is waning, and twilight begins to fall, like the modest golden-crowned woodland warbler, we, too, may lift up our hearts and voices in rapturous praise and thanksgiving, losing ourselves in the great joy of a realization of the Father's blessings.

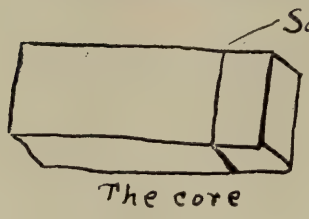
Simple Devices for Bird Attraction

C. C. LEESON
State Normal, Maryville, Mo.

Many people are deterred from making efforts toward bird attraction by the excessive cost of the ready-made devices or for lack of time and skill for carrying out the rather complicated directions usually given for making bird houses. Here are some simple devices that a child can make with a hammer, saw, and hatchet, and yet which are adequate and attractive.

Split-log nest; -split four slabs off a moderate sized stick of wood, leaving a square core, saw one end of this core off and nail the slabs back on to it as a bottom, saw a notch in the top of the front slab for bird opening, (one inch for wrens, one and three-quarters for

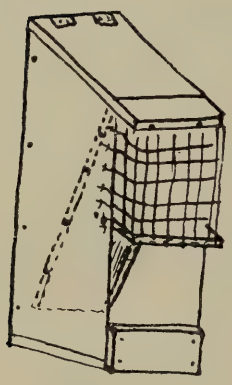


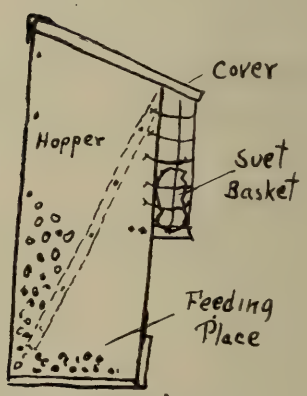


Split log nest

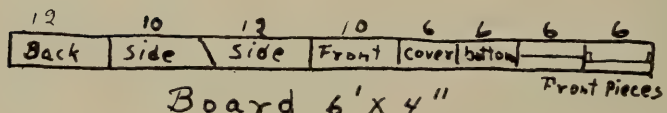
The end

Bark-covered Tin can





Combination food hopper, suet basket



Board 6' x 4"

bluebirds), nail tin cover on top and over this nail another slab for roof, support on shaded corner of house or shed as shown in figure.

Tin can nest with bark cover; fit board to one end of tin can, (this need not be round but angular, hence the use of plain saw), saw notch for bird opening, nail in place, then wrap can with pieces of old bark which readily fall off weathered sticks, secure bark by wire band which may be extended as a hanging support for nest.

Combination grain hopper and suet basket; saw a six foot piece of ordinary 4 x 1 board as shown in diagram, nail together as indicated in figure, hinge the top on the back with a piece of leather and nail extension on its front as a roof for suet basket, add also an extension in the middle of the front and tack on a piece of coarse hardware cloth or fine chicken wire as a retainer for suet.

The writer has several of these devices about his home and finds great pleasure in the bird companionship which they have brought as a return for so little effort put forth.

The Belted Kingfisher

HENRY KLEIN
Brooklyn, N. Y.

Nature has given her tool-using animal, Man, a brain. With brain power he has discovered the resources of the earth, the sea, the air. With brain power he has mastered many of the elemental forces and reached the present level of civilization. It is by brain power that he must yet climb to higher and even higher levels of civilization and welfare. How has he done it? Chiefly by devising tools for himself. With these tools he has become all.

At this point I wish to insist upon the fact that mankind would now have but a small proportion of its useful and useless tools had not Nature furnished him models. The human engine, the brain, would have been by itself entirely inadequate to the task of raising Man to the pinnacle. Models in Nature have always helped him. He has had to use them. He will be compelled to rely upon them in the future. Can he conceive anything without having first perceived?

It would be most interesting if we could follow every idea, every invention, to its source. Our needles, trowels, forceps, spears, awls, chisels, picks, hooks, scoops and strainers are all found in a

natural state. They and hundreds of our other tools, large and small, are found in the equipment of numberless animals. All those above mentioned are to be found in the equipment of birds.

The woodpecker pounds himself out a home by means of his chisel-shaped bill. With his long bill the hummingbird sucks honey from the flower cups. The beak of the hen horny and sharp, is her pick and nippers with which she finds her food, seeds and insects. Mention the snipe, and you will image long legs wading thru mud and water. Mention the kingfisher. What associated thoughts spring to the fore? Well, it is precisely because there are so many associations called into play that about the kingfisher I have so much to say.

The word, kingfisher, immediately suggests his other name, halycon, more properly alcyon. Halcyon is the poetic name of the kingfisher of whom the ancients fabled that it bred about the time of the winter solstice in a nest floating on the sea, and that it charmed the wind and the waves so that the sea was especially calm during the period.

In 1398 Trevisa writes "On the cliffe of a ponde of Occean, Alicion, a see foule, in wynter maketh her neste and layeth egges in 7 days and sittyth on brood . . . seven days." In 1545 Joye—"Thei saye, that in the . . . coldest tyme of the yere, these halcions (making their nestes in the sea rockis or sandis) wille sitte their egges and hatch forth their chickens." In 1601 Holland—"They lay and sit about mid-winter . . . and the time whiles they are broodie, os called the halcyon daies; for during that season the sea is calm and navigable, especially in the coaste of Sicilia." In 1750 Sherstone—"So smiles the surface of the treach'rous main as o'er its waves the peaceful halcyons play."

So anything, any mood that is calm, quiet, peaceful, undisturbed is halcyon.

If ever admirable adjustment existed between a bird's habits and its structure, it exists in the kingfisher. If ever a bird was adapted for his life's work, it is the kingfisher. A young kingfisher seems to grow like a potato in a cellar, all the growth going to the end nearer the light. He sits looking out towards the door, and of course, his face naturally all goes to beak. Everything is perfected to furnish him with a big head, a spear-pointed bill, and a pair of strong wings to give him a good start when he dives for fish. The kingfisher is very different in form from an ordinary bird; he is

larger than the robin, and his head and fore parts are much larger in proportion; this is the more noticeable because of the long feathers of the head which he lifts into a crest, and because of the shortness of the tail. Of course, he seems top heavy in appearance, but can you guess what use he can put his arrow-like body to? His tiny feet are deformed and hardly large enough to support him, but I am sure a kingfisher would not pretend to walk; neither has he any need for running and hopping, like the robin. Did you ever stop to think, by the way, how closely the color of his coat may match the water? Were you ever lucky enough to look at him from above with the blue water behind him?

This Izaak Walton of birddom, whom you may see perched as erect as a fish hawk on a snag in the lake, creek or river, or on a dead limb projecting over the water, on the lookout for minnows, chubs, red fins, samlets or any other small fry that swims past, is as expert as any fisherman you are ever likely to know. You cannot with increasing knowledge of the halcyon lose your wonder, or cease to admire him. You will never possibly overestimate the difficult requirements of an expert fisherman. Sharp eyes are necessary to see a little fish where sunbeams dance on the ripples and the refracted light plays queer tricks with one's vision. It can't be an easy thing to hit a fish in smooth water, it certainly can't be an easy thing to hit a fish in rough water. A friend of mine was sitting on the bank one day when a "king" came rattling down the river in swift, straight flight, and swerving up, caught himself in mid-air and came to a stop about fifteen feet above the water. How exciting it must have been to watch him! What an eye he must have to see a fish under the surface when going at such a pace! He fluttered for a moment as a sparrow hawk does above his prey, and dropped, arrow-like, completely disappearing beneath the surface. The next instant he was in the air again with a cray fish. He wasn't wet a bit, for his clothes are water-tight; the water ran off his satiny plumage as if his coat were thoroly oiled. In addition to his thick, oily plumage as water-proof as a duck's, he wears a suit of down underclothing beneath.

Once a victim is sighted, how swiftly the lone fisherman dives thru the air and water after it, and how accurately he strikes its deathblow behind the gills! If the fish be large and lusty it may be necessary to carry it to the snag and give it a few sharp knocks with his long pwerful bill to end its struggles. These are soon over,

but the kingfisher's have only begun. See him gag and writhe as he swallows his dinner, head first, and then regretting his haste, bring it up again to try a wider avenue down his throat! But why head first? Simply because the kingfisher being sensible, chooses the most sensible method of swallowing the fish, so that the fins will not prick his throat nor the scales rasp it. He swallows the entire fish, trusting to the internal organs to select the nourishing part. Somebody once shot a "king" that had tried to swallow so large a fish that the tail was sticking out of his mouth, while its head was safely stored below in the bird's stomach. After the meat digests, the indigestible skin, bones, and scales of the fish are gulped up in a ball without the least nausea.

It is small wonder that the kingfisher supplements his fish diet with various kinds of the largest insects, shrimps and fresh water mollusks when we look on his evident distress with the fish food. The many abortive efforts he makes to land his dinner safely below in his stomach, his grim contortions as the fish bones scratch his throat-lining on their way down and up again force more than one smile from us. But let us not be prejudiced because it appears to us as distress. This bird adapts himself to circumstances just as a flicker will dig a home in a clay bank, a telegraph pole, or a church steeple when the trees are all cut down. In the east, if opportunity offers, he eats crustaceans, grasshoppers, crickets, and beetles of the June bug family. Along some stream he lives mostly on frogs, lizards, and beetles. In the Southern States, where the streams are few and run dry in summer, our adaptible fishermen takes to a fare of grasshoppers and mice. Think of a kingfisher catching mice! In Arizona, where rivers are also scarce and deserts plenty, he lives mainly on beetles, grasshoppers and lizards.

A certain part of a favorite lake or stream this fisherman patrols with a sense of ownership and rarely leaves it. Alone, but self-satisfied, he clatters up and down his beat as a policeman, going his rounds, might sound his rattle from time to time. Sometimes he flies so low you can see his reflection in the water; but again goes high above, cleaving the air so swiftly that before you have had time to rejoice at his loud, stirring rattle and made up your mind to follow him, he has left you far behind. Mr. Burroughs says that if you do "follow the rattles . . . he will show you the source of every trout and salmon stream on the continent," adding that he always fishes alone. In this statement we heartily concur,

because this rattle-leader bird knows every pool where minnows play, every projection along the bank where a fish might hide, and is ever on the alert, not only to catch a dinner, but to escape from the sight of the human intruder.

This is in line with Mr. Widmann's theory of the inability of some birds to indulge the social instinct, for the Kingfisher's feeding habits may well necessitate private preserves. Whatever seabirds may do, troutstream fishermen can ill afford to go in flocks. Can you step into the boots, or rather the plumage of the kingfisher for a moment? Can you put yourself in his place? You could not possibly be a social bird like the chippy and chickadee, could you? The kingfisher seems to think as you would, that a companion would talk and scare the fish.

Have you ever watched the kingfisher along Fall Creek? Here he comes flying over the tree-tops, with his head high in the air, and, like the boat coming in at the wharf, he sounds his rattle before landing. He perches on a dead limb overhanging the water. It seems that this is one of his lounging outlooks, and not his place of business. No angling here! Occasionally he turns his head, and watches the water carefully. What a big, chunky bird he is, fully a foot long! The crested feathers on top of his big, powerful head reach backward to the nape like an Indian chief's feather bonnet, and give him distinction. His colors are beautiful and harmonious; the upper parts are grayish blue, the throat and collar white, as is also the breast, which has a bluish gray band across the upper part, this giving the name of the Belted Kingfisher to the bird. The feathers of the long strong wings are tipped with white, the feathers of the short, square tail are narrowly barred with white. He has posed for us unintentionally, of course, but he seems to be getting restless. It may be he is aware of our presence. We have barely time to catch a glimpse from our hiding place of a striking white spot just in front of the eye, and he is off, not with whoop and a yell, but a rattle.

Not especially pleasant close at hand, but not unmusical at a distance is the note of the kingfisher. Flying well over the tree tops or along the waterways, he makes the woodland echo with his noisy alarm-clock like rattle, that breaks the stillness like a watchman's at midnight. It is perhaps the most familiar sound heard along the banks of the inland rivers; "it is a sound that conjures visions of shade-dappled streams and the dancing, blue waters of

tree-fringed lakes and ponds." No love or cradle song does the kingfisher know. Instead of softening and growing sweet, as the voices of most birds do in the nesting season, the endearments uttered by a pair of mated kingfishers are the most strident, rattly shrieks ever heard by lovers. It sounds as if they were perpetually quarreling, and yet they are really particularly devoted.

No doubt you have heard that all birds are descended from reptile ancestors; that feathers are but modified scales, and that a bird's song is but the glorified hiss of the serpent. Then the kingfisher and the bank swallow retain at least one ancient custom of their ancestors, for they still place their eggs in the ground. The young are raised in such a dark, damp place you might think, at first sight, that all of them would die of consumption. They never get even a glint of sunlight till they are old enough to climb out of the cave and take flight. Think of living in a deep well till you are grown!

The lone fisherman chooses a mate early in the spring and, with her help, he tunnels a hole in a bank next a good fishing ground. A minnow pool furnishes the most approved baby food. Like the bank swallows, tho their feet are undeveloped, short and weak, they use them as trowels for excavating holes in sandbanks, etc. The third and fourth toes are joined together, which undoubtedly assists the kingfisher in pushing out the soil when excavating. Major Bendire says that while it may take a pair three weeks to excavate their nest, he has known them to make a tunnel five feet long in a little over three days. The tunnel in the bank is a horizontal one. Sometimes there is a vestibule of several feet before the nest, the spacious nursery is reached, and at other times it is built very close to the opening. Uusually from five to eight white eggs are laid about six feet from the entrance on a bundle of grass, or perhaps on a heap of ejected fish bones and refuse. The fact that his house is carpeted with such a rough floor must be entirely incidental, since the food of the young is largely fish. Two alternative propostions are probable: (1) The kingfisher wants to adorn his home with the trophies of his many hunts. (2) He is too lazy to carry in anything else.

About the Kingfisher's home life I can do no better than by referring to the very interesting observations made by Mr. W. L. Bailey. "A hole in a bank seems a strange place in which to build a nest, but altho one may know it to be the home of a kingfisher, he

little imagines the singular course of the passage leading to the room at the other end, and is hardly aware of the six long weeks of faithful care bestowed by the parent birds upon their eggs and family.

"The mother bird, as usual with the sex, does most of the work at home. The hole is generally located high upon the bank, is somewhat less than four inches in diameter, and varies from at least five to eight feet in length. It slightly ascends to the dark mysterious den at the other end,—dark because the passage generally bends once or twice, thereby entirely excluding the light. The roof of the passage is vaulted from end to end, merging into a domed ceiling almost as shapely as that of the Pantheon. Such a home is built to stay and if undisturbed would endure for years. Two little tracks are worn by the female's feet the full length of the tunnel as she passes in and out.

"The kingfisher's knowledge of construction, her ingenious manner of hiding her eggs from molestation, and her constancy to her young arouse your interest and admiration. We must also appreciate the difficulty with which the digging is attended, the meeting of frequent stones to block the work, which, by the way, may be the cause of the change of direction of the hole, but which I was inclined to believe intentional until I found a perfectly straight passage, in which a brood was successfully raised.

"To get photographs of a series of the eggs and young was almost as difficult a task I believe as the Kingfisher had in making the hole. It was necessary to walk at least four miles and dig down to the back of the nest, thru the bank above, and fill it in again four times, without deranging the nest or frightening away the parent birds. . . .

"A photograph of the seven eggs was taken before they had even been touched, and numerous disgorgements of fish bones and scales show about the roomy apartment. The shapely domed ceiling, as well as the area of the passage, is constructionally necessary for the safety of the occupants. . . .

"Some writer has mentioned that as soon as the young Kingfishers are able, they wander about their little homes until they are able to fly, but evidently his experience was limited. My four pictures of the young birds were taken by lifting them out of their nests and placing them in a proper place to be photographed in the light, but the first two pictures were taken in the positions in which

they were naturally found in the nest. The first was obtained when they were about two days old . . . and the young were not only found wrapped together in the nest, but the moment they were put on the ground, one at a time, tho their eyes were still sealed, they immediately covered one another with their wings and wide bills, making such a tight ball that when anyone shifted a leg, the whole mass would move like a single bird. This is a most sensible method of keeping warm, since the mother bird's legs are so short she could not stand over them, but, as they are protected from the wind and weather, they have no need of her. Their appearance is comical in the extreme, and all out of proportion. This clinging to one another is apparently kept up for at least ten days, for a week later, when nine days old they were found in exactly a similar position.

"When the young were first observed, they were absolutely naked, without the suggestion of a feather, and, unlike most young birds, showed no plumage of any kind until the regular final feathering, which was the same as that of the adult, began to appear. The growth of the birds was remarkably slow, and even when nine days old the feathers were just beginning to push thru their tiny sheaths, but so distinctly showed their markings that I was able to distinguish the sexes by the coloring of the bands on the chest. They did not open their mouths in the usual way for food, but tried to pick up small objects from the ground, and one got another by his foot, as the pictures show. I took two other photographs the same day, showing several birds searching on the ground with their bills, as if they were already used to this manner of feeding.

"When the birds were sixteen days old, they had begun to look like formidable kingfishers, with more shapely bills and crests, but as yet they evidently knew no use for their wings. They showed little temper, tho they appeared to be somewhat surprised at being disturbed.

"My next visit to the hole in the bank was when the birds were 23 days old, and, to ascertain whether they were still at home, I poked into the entrance of the hole a long, thin twig, which was quickly accepted by quite a strong bite. Taking the precaution to stop the hole with a good-sized stone, I proceeded to my digging for the last time on the top of the bank. This time I found the chamber had been moved, and I had some difficulty in locating it

about a foot higher up and about the same distance to one side. The old birds had evidently discovered my imperfectly closed back door, and either mistrusted its security, or else a heavy rain had soaked down into the loosened earth and caused them to make alterations. They had completely closed up the old chamber and packed it tightly with earth and disgorged fish bones.

". . . Their home was kept perfectly clean by its constant care-taker. One of the full-grown birds, with every feather, as far as I could see, entirely developed, sat just long enough for me to photograph him, and then flew from the branch where I had placed him, down the stream, and out of sight, loudly chattering like an old bird. . . The rest I left in the nest, and no doubt they were all in the open air that warm, sunny day, before nightfall."

So it takes almost four weeks of feeding and nourishing, according to this and many other accounts, before the young kingfishers are able to leave the hole in the bank. Even at this time the youngsters are not strong on the wing. In due time all the family of young anglers, wild-eyed, frowzy-headed, make their way to the pond, or lake, when they perch on the projecting snags over the water. They are not experts on the wing nor can they spear a fish, but they are not too old to learn. Watch one dive horizontally for a yard or two beneath the water. Has he a fish in his bill? It seems not. I wonder what his feelings must be. But willy nilly the young birds must now break away for themselves in the great world of bird life. What wonderful parental devotion was shown them. What wonderful devotion will they in their turn show.

Both parents have been industrious in catching fish for their nestlings. The devoted male had, of course, done most of the angling, while the mother was brooding. Both parents have been always on guard to drive off mink, rats and water snakes that are the terrors of their nursery. They have kept the airline trail hot between the pond and the bank, while fishing; they have made it hot for those who tried to disturb the tranquility of their beloved.

Audubon says that when the young are in the nests, the mother, if disturbed, will sometimes fall on the water as if severely wounded while her mate on a branch above shows his perturbation by jerking his tail, raising his crest, rattling, and flying anxiously back and forth.

We have gone in some detail into the life history of the Belted Kingfisher. We hope that we have given you at least a glimpse

into his interesting personality. Because we think that your interest has been aroused we shall add a few words about his relatives. It may be you will inquire into their life. Our kingfisher has very many relatives in the malay Archipelago. In fact, they are most numerous there, making the majority of the one hundred and ninety known species. There are only seven American species, all contained in the genus *Ceryle* (our own angler is *Ceryle alcyon*), which has also five representatives in Africa and India. Our seven species are confined chiefly to the tropics, only one advancing north of southern Texas. This one, our own, goes south late in autumn, winters in the Gulf States, and returns north early in spring.

Just one more word. Some people advocate shooting the kingfisher at every opportunity, and, in some places, men have made laws to exterminate him claiming that he destroys too many young trout. But the Kingfisher eats very few trout comparatively. He lives largely on the kind of fish that are of little or no use to man. What if he does catch an occasional trout to eat? Is man the proper defender of the trout? Man who never destroys? Man who never wastes! The kingfisher was here long before man came; he must have some rights, at least the right to live a secluded life along the waterways where there are no trout. What shall we gain by his extermination? What shall we not lose?

We must be content to enjoy the kingfisher as a feature in the landscape, as the center of a picture of woods, ponds, or river, to which he gives the needful touch of life. The river scenery in early Spring is lifeless and dreary, for, if the snow has melted and the ice broken up, the bushes along shore are beaten down by the storms of winter or partly submerged by the spring freshets. Here and there, in sunny spots on the low shore, we may see the purple-pointed hood and bright green leaves of the skunk-cabbage, but if a kingfisher is perching on a dead branch overhanging the water, crest erect, eyes alert for a fish to pass, the scene becomes full of interest.

Man, you are a divine creature. You have committed sins enough when you have subordinated your wholesome prides and desires to your greed for gain. Do not taint, do not poison the honor and dignity of human life any more than you have already done. Nature has furnished you the models without which you could not have reached your present height. Do not show your gratitude by destroying these very models.

Several Bird Notes

George B. Happ
Port Jervis, N. Y.

Blossom time in the spring of the year was here. Pink, white, and pink and white petaled blossoms with which each tree top dotted here and there was rounded into billowy clouds of light and color neath the clear blue sky, were massed above the broad grass top covered lawn that stretched on dipping down to where it met not the lower slope that we usually saw below, but a grayish blue rolling surface of mist that quite filled the valley to the other side, all soft toned, where now and then the slant of a house top glinted in the first early morning sunlight that had just appeared, now touching the nearby tree tops until they were a splash of gay color and casting blue shadows o'er their gray trunks and the grass below, whose fresh greenness was now a solid glow.

Numbers of the northward bound host of travelers of the Bird-land Folk had been seen on previous days and we had hoped to see many more this morning. And as we paused there was quite a large songster in a nearer tree top, plump rosy breasted, darker backed, that bubbled forth "cheerily-cheerily-cheer up-cheer -up," and then with several long quick flaps, he had settled on the grass tops a short distance away.

We knew him well as almost everyone does, since with the first toddling footsteps along the garden walk, chubby hands had pointed at the friendly form that had run alongside and then quickly, pertly, stopped head erect; American Robin. He was Robin Redbreast of the story book books, a cousin in a way to a smaller red-breasted Robin of England overseas, after whom some early colonists to this country had named him.

"Look look-look-look," he called turning a little.

"Good morning," we said, "We are looking. At least we're trying to see most things hereabouts. And its very pleasant here we think."

"Good-morning," he replied nodding his head slightly in greeting. Most everyone does like blossom time in May and they often pause in passing."

"Just as we are doing, perhaps," we answered. "But what did you mean when you just said 'look-look?'"

"Why we Robins mean different things at different times," he said. "People that know some of the birds quite well sometimes

do not remember that many of them have several different notes you know. As we Robins call 'cheerily-cheer-up,' and 'look-look' and also 'quick-quick-quick,' as when young Robins on their first flights do not always know about perching on the tree branches but flutter along on the ground instead. And each of these calls or notes has a different meaning or season which can be learned by those who watch carefully. Chickadee you know, in his black-capped and gray breasted coat, also calls besides his own name, 'Chicakadee,' a call, 'Phœbe,' that sounds somewhat like that of familiar dark backed Phœbe. And Junco that calls lightly from the wayside bush tops all through the wintertime, has another a sweet toned trill as he leaves for his northern homeland. White-breasted Nuthatch who runs up and down and across the tree trunks with broad sounding notes, in the springtime has a rolling toned song that we do not always think of as of Nutchatch's. Another, Bobolink, that bubbles so sweetly as he sways o'er the meadowlands, in the Southland becomes a quiet toned brown coated fellow and is called Reedbird. While these warbler folk one does not remember so well from their song when they come southward in the falltime, just a few light toned notes as they flit among the bush and tree tops with now and then a wee bit of song. And most of the birds about here have a number of different notes beside their song and call note which most people usually know first. Parent birds often try to encourage the young birds in their first flight and call differently; others find cosy nooks or pleasant slopes or sheltered perches and call forth to their neighbors. And some birds have a 'flight' note it's called given just before or while swinging forth from a bush or tree top. And there are many others quite as interesting."

Robin had remained quite erect and still while speaking and now bowed several times.

"We thank you for telling us of that," we said quickly as he passed. "And we're sure it will make it all the more pleasant and interesting to become acquainted with the Folk of Birdland."

"I hope it will," he said and then swung on to a farther stretch of green grass tops, while on all sides notes could be heard again and again, as we sauntered along through the Bird land Chorus of the spring morning.

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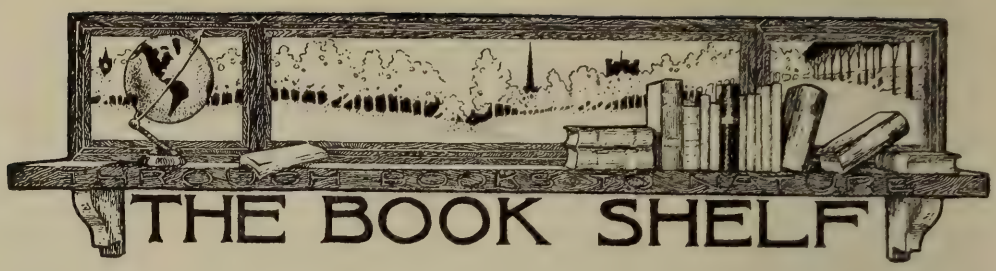
Editorial

THE LOVE FOR BIRDS

One May morning we chanced to observe a rugged old farmer standing beneath an apple tree, listening intently to the song of a robin that was putting forth its best efforts as a virtuoso on the topmost twig. The listener's face was lifted, a happy smile radiated from the lips over the glowing ruddy cheeks and reached the shining eyes which were as blue as the sky above. In that scene this man's character was made manifest and it was no surprise later in the day to see him, as he toiled up across the hill pasture, followed by a procession consisting of the horse, the cow, a dozen hens in straggling parade, the dog and the cat,—every animal at liberty in the pasture, all trailling contentedly his beloved footsteps. His generosity, his never failing kindness to the unfortunate, his loving care for every one and everything dependent upon him were all clearly revealed.

"Mild and gentle as he was brave,
When the sweetest love of his life he gave
To simple things; where the violets grew
Pure as the eyes they were likened to
The touches of his hands have strayed
As reverently as his lips have prayed."

While writing the outline for bird study in the grades for this number of the REVIEW there was one thought uppermost: "How can we, in teaching about birds be sure that we are inducting into the child heart a love for birds; a love that shall be unselfish and protecting; a love that shall act as the fundamental factor in building the gentle character; a love that once implanted will grow through natural nourishment until it shall be able to enfold comfortingly all who are in need. Unless bird study accomplishes this it will not reach its highest success.



The Book of Birds, by Henry W. Henshaw, Illustrated in Natural Colors with 250 paintings, by Louis Agassiz Fuertes, published by National Geographic Society, Washington, D. C., $3.00.

No more important book has been published recently for bird lovers or for teachers of Nature-Study than this volume which is made up from articles and illustrations published in the National Geographic Magazine during the last six years. We used extensively the small book which preceded this volume and which contained descriptions and pictures of the common birds of town and country. The beautiful colored pictures were used with our classes as models in coloring bird outlines. The present volume includes also the warblers and the game birds of the United States which makes it most complete as well as important. Mr. Henshaw writes delightfully of the birds and Mr. Fuertes' paintings are superb. Without question Mr. Fuertes is the leading bird artist of the world. The volume also contains articles on the World Record for Feathered Friends by Gilbert Grovenor, How Birds Can Take Their Own Portraits by George Shiras, 3d, Encouraging Birds Around the Home, by Frederick H. Kennard, and Our Greatest Travelers—Bird Migrations by Wells W. Cooke. Every bird student should have this volume in his library, and it should be in every school library in America.

A Field and Laboratory Guide in Physical Nature-Study, by Elliot R. Downing, Associate Professor of Natural Science in the School of Education of the University of Chicago, The University of Chicago Press, $1.00.

This is the volume for which we have been eagerly waiting and now that it is in print we find it well worth waiting for. While turning its pages we were possessed with a longing to become a grade teacher and begin this fascinating line of Nature-Study. The following from the introduction gives the scope of of the book: "Before the pupil has completed the junior high school he should be assured of a range of experience with commonplace science that will habituate him to see and to attempt the solution of problems in a scientific way, that will give him command of the most important principles of science and that will make him appreciative of the wonders to be found in his commonplace environment. This book attempts to prepare the teacher to intelligently use the physical materials of interest to the pupil to achieve such ends."

The book includes the following: The study of forty common minerals and twenty-seven common rocks with directions for studying them The stars and our solar system with simple directions for finding the most important constellations and for making a star-finder. Some toys that work by air, such as making of windmills, kites, aeroplanes, sail-boat, motor-boat and water-wheel. The making of a top, sling, and bow, hot air baloon. Some common

appliances that operate by heat including the making of ice, clouds and the why of freezing ice cream, of wire handled pokers, storm sash, thermos bottle, fireless cooker, house heating, fire, gunpowder, coal gas and the gas engine. A discussion of magnetic and electric toys which begins with the bar magn t and ends with an electric motor and toaster. Experiments in making a camera, a telescope and a magic lattern, also the making of the instruments for an orchestra, the making of a phonograph and telephone, the making of scales, pulleys, jackscrew ,etc. The appendix gives a list of apparatus and supplies required in working out the projects suggested in the book, and also a list of books of reference which would be very useful to the teacher. The book is in the form of a notebook, perforated and held with ring fasteners and has blank interleaves for notes. It meets every need for teaching physics in junior high school. Every project described is based upon experience and is therefore practical. The book is sure to be widely used. It should be in the hands of every teacher in the land who has to do with seventh or eighth grades or high school physics.

The Nursery Manual, by Liberty Hyde Bailey, 456 pages, illustrated, Macmillan Co., price $2.50.

This is really the old reliable manual that we have used and sworn by for thirty years, but it has been rewritten and brought up to date and made one of the Rural Manual Series; that this is the twenty-second edition shows the wide appreciation of the usefulness of this book. Part first is given to the Classes and Kinds of Propagation which includes a discussion of Seeds and Shoots, Propagation by Means of Seeds and Spores, Propagation by means of Separation and Division, and by means of Layers and Runners, of Cuttings, of Budding and Grafting and a long and practical chapter on El ments in Nursery Practice. Part second is devoted to a Nursery list which is very important and fills half of the book.

The style of the book is terse and clear, an ideal style for a practical book and it is another evidence of the author's versatility that he could write the *Holy Earth, What is Democracy*, in such wide contrast in style and subject matter. We predict another thirty years of ever widening use and influence for the *Nursery-Manual.*

Snapshots of the Wild, by F. St. Mars, 244 pages illustrated, J. B. Lippincott Co.

This is a book of English Nature stories and all the more interesting because it deals with the wild life of our mother country whose essayists and poets have given us tantalizing glimpses of these creatures which we have known only by name. "Snapshots" is an excellent name for this book because the stories in it are short, graphic, dramatic and interesting. Mr. St. Mars knows how to tell a story that thrills and which holds the reader enchained to the end. He also is given to most felicitous descriptions: "The pin point squeak of a bat." "You know the beautiful little teal duck with gold and green spectacles and a breast fit for a king's lunch." "They flew in silence, and all alone—nine little birds out of the south and the night—over the cold, restless sea towards England. Sandmartin was their name, and Africa was where they had come

from, all alone, and by night, for fear of the gulls and the hawks." "Goodness knows if the squirrel meant to eat the hawfinch or the acorns first. Goodness knows if he knew himself, being a squirrel. Anyway, there he was, a flaming picture of dainty, irresponsible, starry-eyed, untrustworthy—from a bird's point of view—but sportive life." "The jay stood on the spot vacated by the squirrel and shrieked his harsh, grating shriek, 'he did—he,' the rogue of the woods, the jester of the sombre places."

There are four stories for each month in the year and for some months more, for there are fifty in all. Some of the stories deal with life from Africa and Northern Europe and in them are descriptions of many species of birds, mice, voles, rabbits, beetles, flies, chameleons, antelopes, wolves, lions, hyenas, snakes and many others. It is a fascinating volume.

Problems in Botany, by W. L. Eikenberry, Associate Professor of Education, University of Kansas, Ginn and Co.

This little book which gives 118 exercises clearly outlined is very much alive and the Nature-study teacher and the teacher of gardening as well as the teacher of high school botany will find it full of vital and practical suggestions. The first chapter, Plants and Water will prove most helpful to the teacher who is preparing her class for gardening. The chapter on Nutrition gives examples for studying how plants bake and use food. The chapter on Provision for Growth begins with the opening of a bud which is an excellent nature-study lesson and shows also how to study the history of the growth of a branch. Other chapters deal with—Reproduction and Propagation, Seed Dispersal, Seeds and Seedlings, Relation to Environment, Relation of Simple Plants to Man's Life and Industries, Mosses and Ferns, Gymnosperms, the Flowering Plants, and Plant Industries.

This is a book for the do—er. It takes the pupil afield to see things for himself and teaches him to be independent of books· if he does any reading, it will be a translation of his own from Nature's pages.

The Oven Bird

In the hollow of the mountains,
In the valley spreading from them,
Stand the rustling broad-leaved forests
Trees whose leaves are shed in autumn.

Underneath them lie the leaf beds,
Resting one upon another,
Laid there yearly by the storm winds;
Pressed and smoothed by winter snowdrifts.

In the days of spring migrations,
Days when warbler hosts move northward
To the forests, to the leaf-beds,
Comes the tiny oven-builder.

Daintily the leaves he tiptoes;
Underneath them builds his oven,
Arched and framed with last years oak leaves
Roofed and walled against the raindrops.—Bolles.

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(Continued on Next Page)

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Kingfisher, The Belted
Kinglet, The Golden-crowned
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Lark, The Meadow
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Oriole, The Baltimore
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Phoebe, The
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Sparrow, The Chipping or "Chippy"
Sparrow, The Song
Sparrow, The Vesper
Sparrow, The White-throated
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The Patio, Professor Campbell's Garden

TABLE OF CONTENTS

The Springtime Garden in California. D. H. Campbell - - 181
Trouble with Two Tatus. John C. Branner - - - 189
California—Poem. A. W. Smith - - - - - 194
At Palm Springs with the Sierra Club. Julia E. Rogers - 195
A Stanford Garden. David Starr Jordan - - - - 198
The Little Brushbird; Implications; The Song of the Thrush; The Day Lily—Poems. By Irene Hardy - - - 202
The California Nature-Study League. C. M. Goethe - - 204
Song of the Meadow Lark; Old Man Coyote. Carrol DeWilton Scott - - - - - - - - - - 208
Mount Shasta Camp for Nature Lovers. Bertha C. Cady - 209
A Strange Pet. Snow Longley - - - - - 214
Agriculture in the Elementary Schools of Los Angeles. C. F. Palmer 217
An Earthworm Elegy. Albert W. Smith - - - - 221
A Symposium of California Nature Stories by the Nature Students in Chico Normal School: California's Humming Birds, Lila Shearer; California's Tree Islands, Dolores Riley; Mt. Lassen, Calley Boyle; The California Bush Tit, Margaret Sherman; The Flower Land—California, Pauline Kirkhuff; The Redwood, Belle Thompson; Precious Gem Mines in California, Lloyd Brooks - - - - - - 222
Editorial - - - - - - - - - - 232
Book Shelf - - - - - - - - - - 234

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THE
NATURE-STUDY REVIEW

VOL. 16 MAY, 1920 No. 5

The Springtime Garden in California

DOUGLAS HOUGHTON CAMPBELL
Professor of Botany, Stanford University

The Easterner transplanted to California, finds it at first rather hard to adjust himself to the seasonal changes which are so different from those to which he is accustomed. In California the all-controlling factor is rain, For several months, generally speaking from May to October, practically no rain falls, and plants which are not specially adapted to withstand this long drouth must perish.

The grass in the hills is dried into natural hay, and the gay annuals which painted the meadows and hillsides, in spring, with great masses of vivid color, have ripened their seeds and died. Herbaceous perennials have gone to rest until awakened by the first Fall rains, and except for the trees and shrubs, there is little verdure to be seen, and the summer landscape has a very different aspect from that of the Atlantic States.

Just as soon, however, as the first rains of Autumn fall, there is a quick change. Sometimes, if the first rain is fairly heavy, within forty-eight hours one can find millions of little seedlings sprouting in the low places where the water has settled, and in a few days a film of tender green spreads over the ground, which deepens in tint as the days go by, and advances up the hillsides, which are soon covered with a dense growth of grass and many sorts of plants which bye and bye will be covered with masses of brilliant flowers.

Usually the first good rains come in October, at which time we may say spring begins, to last through the winter months, and finish with the last showers in April or May. There is rarely cold enough to stop the growth of hardy plants, even in midwinter and our gardens are pretty well stocked with flowers all through the winter. Sometimes there is not enough frost to damage even such tender plants as heliotrope and nasturtiums; and in

The Fountain
Tree Peony

Japanese Cherry
Callas

mild winters many flowers keep on blooming without any interruption.

Some flowers that we are wont to associate with early spring, are wakened into bloom by the autumn rains, and in California begin to flower in the late autumn and early winter. Thus, by Thanksgiving, one may find sweet violets, early narcissus and snowdrops competing for attention with chrysanthemums, dahlias and other typical fall flowers. Several of the native shrubs and trees open their flowers in the autumn and early winter, and some of these are very attractive and quite commonly grown in the garden.

One of the first to respond to the first rains, is a charming wild currant which opens its drooping clusters of rosy flowers and unfolds its fresh green leaves very soon after the first heavy rains have soaked the ground. Before Christmas the first buttercups and a little white cress can usually be found in bloom,—the forerunners of the hosts of beautiful wild flowers for which California is famous.

Another characteristic and attractive winter flowering native shrub is the manzanita, with broad evergreen leaves, whose clusters of white and pink waxen bells usually open before the New Year. Less showy, but attractive in a quiet way, is the silk oak (Ganya), with grayish leaves, and very long, graceful catkins of yellowish flowers.

About the time that these native shrubs are well in flower, the Japanese quince begins to light up the garden with its gorgeous scarlet blossoms, and this is soon followed by the pink Japanese plum, which is usually in flower by the middle of January. These begin the long procession of flowering fruit trees, whose beautiful flowers are a prominent feature of the spring garden. The earliest of these are the almond, purple-leaved plum, and crimson flowered peach, the last a particularly splendid thing. The lovely white and pale pink almond blossoms are at their best in February, and I am sure the cherry blossoms of Japan cannot be more beautiful than the roadsides and orchards of the Santa Clara valley, when the almond trees are clothed with a cloud of pink and white bloom.

In January several species of Acacia are a blaze of gold. These Australian trees are very much at home in California, and the splendid masses of dazzling yellow, very fragrant flowers, are

almost overwhelming. They, however, lack something of the charm of the delicate pink and white fruit blossoms, whose kinship with the roses is so evident.

A notable feature of all Californian gardens is the predominance of evergreen trees and shrubs, which prevent the gardens, even in mid-winter, from looking bare. I do not mean so much the Conifers, as the "broad-leaved" evergreens, like the laurels and holly. These furnish a fine background for the flowering deciduous shrubs and trees, and many of them, like the Camellia, Acacias and brooms, are very showy when in flower.

One must not forget the numerous berry-bearing shrubs and trees, which lend color to the winter garden. Among the showiest of these may be mentioned the firethorn, holly and several species of Cotoneaster with orange or crimson berries. Among these berry-bearing evergreens none is more showy than the native 'Toyon" or Christmas berry, with great bunches of brilliant scarlet berries reminding one somewhat of those of the mountain ash. The pepper tree is also a favorite, its graceful, fine-cut leaves and long drooping clusters of pink berries being most ornamental.

There are a good many native broad-leaved evergreen trees, including several oaks, of which the best known is the valley live-oak, familiar to every visitor to California. Various species of Ecucalyptus are extensively planted, and with several kinds of palms, Yuccas and other tropical looking trees, give a decidedly foreign aspect to most California gardens.

I think my favorite among the winter-flowering shrubs, is the beautiful and deliciously scented Daphne, whose rose-tinted blossoms in form, color and fragrance, recall the arbutus of the Eastern states, although the two are really not closely related.

Except in unusually cold seasons one can always find a few roses in sheltered sunny spots, and in mild seasons roses bloom freely all winter; but it is not until April and May, in our district, that one realizes what rose time in Calirofnia means.

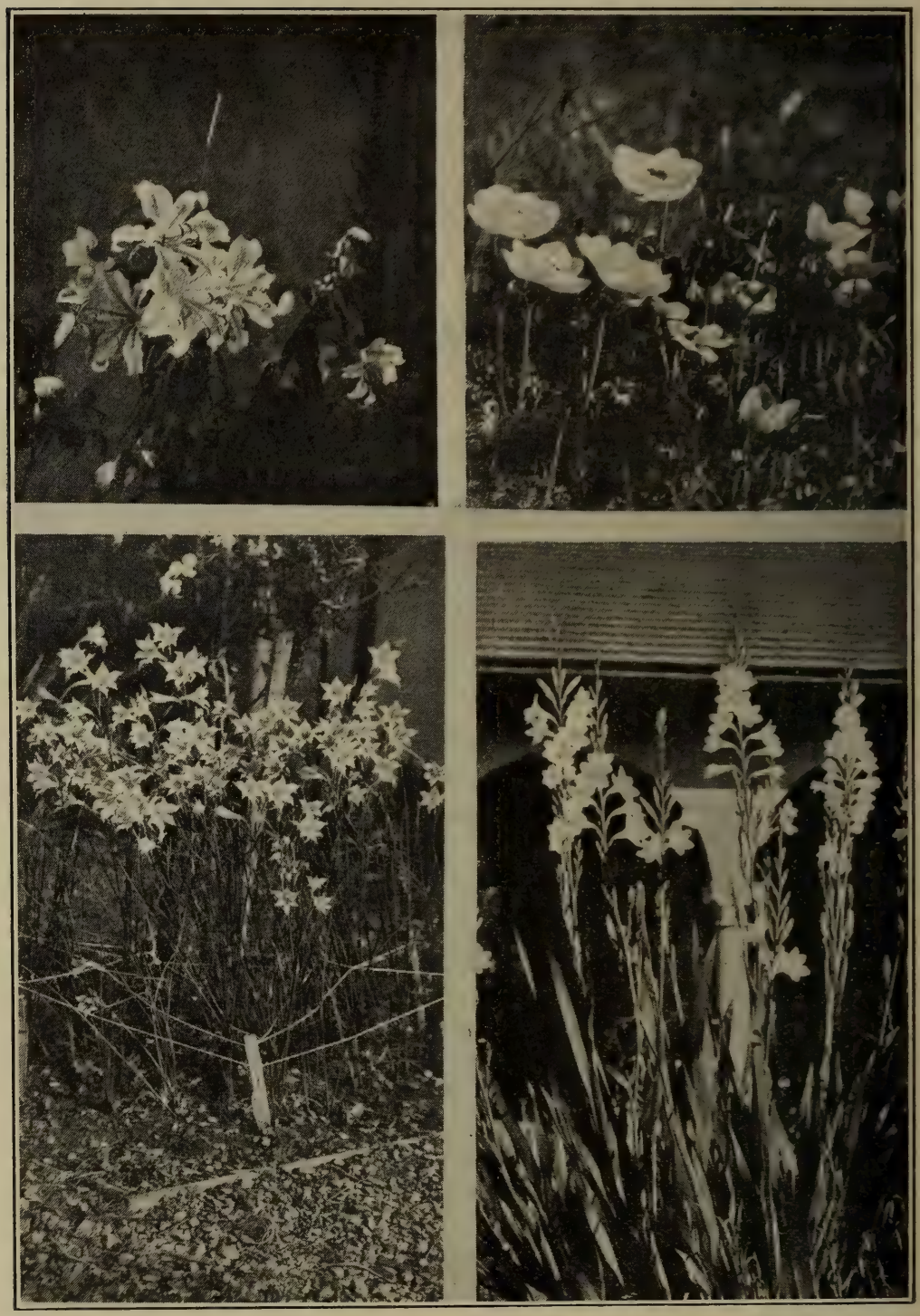
A good many things are in bloom pretty nearly all the year round. Heliotrope, geraniums, pentstemons, snapdragon, and other hardy things may be depended on to flower all winter, except in the severest seasons, when they may be nipped in exposed places.

Among the most satisfactory flowers in California are the many varieties of bulbs, including some very beautiful native species.

Not only the familiar daffodils, tulips, hyacinths, etc., come to great perfection in our region, but many things, like the Freesia, Ixia, and Gladioli are perfectly hardy and once planted, take care of themselves. The many beautiful bulbous plants from the Mediterranean region and from South Africa, grow luxuriantly in California. The gorgeous Anemones and Iris of Southern Europe; the Callas, Freesias and other bulbs from the Cape are equally at home, and in addition there are many less familiar species. Related to Freesia are several showy species of Gladioli, Ixia, Sparaxis Tritonia and Watsonia. These are sometmes grown under glass in the East, but are not hardy outside.

All of these bulbous plants are perfectly adapted to the conditions in California, as they naturally go to rest in the dry season and quickly sprout with the first autumn rains, growing all winter, and reaching the fullest perfection of flower in the late winter and early spring. Of the numerous beautiful spring bulbs, none are more attractive than the various kinds of Narcissus. From the first paper-white, and Chinese "lilies" in November, to the last poet's narcissus of late April or even May, they are among the lovliest flowers of the garden. There are now hundreds of varities to select from, some like the little "hoop-petticoat", only a few inches high, others like the great trumpet-flowered and chalice-flowered daffodils, as much as two feet when well grown. They range in color from pure white, through every shade of cream and gold; some with shallow cups vividly colored, even scarlet in some cases; others with great trumpets, two or three inches long. Sweetest of all are the little jonquils, whose dainty deep yellow flowers are as sweet as orange blossoms. The display of daffodils in February and March, when they open by hundreds—or even thousands—affords, perhaps, the most beautiful floral show of the whole year.

There are many species of Iris which thrive in California, and are among the most beautiful and satisfactory flowers in the garden. They include several handsome native species which are not difficult to cultivate; but there are many other, some of which are common in the Eastern gardens, but others are not hardy and thrive only in California and similar climates. By a judicious selection of varieties one can have Iris in flower almost all the year round. Some species are regularly winter-bloomers, e.g. *I. Stylosa, I. reticulata, I. alata,* which furnish a succession from



Japanese Lilies
Gladiolus tristis

Anemones
Watsonia

October to February, then the beautiful white Florentine Iris begins to bloom, and soon there is a great array of the innumerable varieties of the German Iris and their kin. A little later the graceful Spanish Iris flowers, and still later, the English and Japanese varieties, as well as a number of others.

The daffodils begin in January and reach their climax in February and March, and before they are over, the tulips appear. The little scarlet ones have opened their bright cups in February, but the tall late scarlet and Darwin tulips seldom begin to flower before the end of March, and usually are at their best in April.

Perhaps April yields the greatest show of flowers in our gardens. Before the tulips are gone, the Wistaria, white Clematis, and yellow jasmine, are in flower and rival in beauty the climbing roses which now are masses of bloom, and reach a size which makes the eastern visitor wonder. They form impenetrable hedges, clamber up to the tops of the trees, and fairly smother the houses in masses of flowers. Some varieties, like the little white and yellow Banksias, and the sunset hued Fortune's yellow, are so covered with flowers, one can scarcely see any foliage. Roses, literally by the million, run riot in every garden, however humble.

April is the time also of the later flowering fruit trees, and the many deciduous shrubs—lilacs, Weigela, snowballs, etc., which in the East do not bloom until late May or June. Of these flowering shrubs—or rather trees—none are more showy than the hawthorns which are huge bouquets of pink, white and crimson bloom.

April is the month too for many of the herbaceous perennials although these are usually somewhat later to flower. The herbaceous peonies, which are so splendid in the Eastern June gardens, are not quite at home in California, and require some coaxing in order to give good flowers, but the even more beautiful tree peonies of Japan come to wonderful perfection, if one is willing to give them a little extra attention. They are among the marvels of the floral world, and the huge blossoms, sometimes almost a foot across, but of exquisite color and texture, are without a rival in the garden, and more than repay for the trouble spent in growing them. These imperial flowers open a month or more before the herbaceous peonies, and at about the same time that the flowering Japanese cherries are in bloom.

There are many beautiful native flowers which are easily grown in the garden. Some, like the violets, Trilliums and buttercups,

are not very different from their Eastern relatives; but others, like the gorgeous Californian poppy (Echscoltzia) and the giant bush poppy (Romneya), as well as a bush of brilliant annuals, including the dainty Nemophila, species of Gilia, Orthocarpus, and many others, are quite unlike any of the wild flowers of the Atlantic states. California is especially rich in bulbous plants of the lily family, including some superb species of true lilies. Others, like the exquisite Mariposa lilies, or "Butterfly tulips," the odd Fritillaries, Brodiaea, white, blue and yellow, are among the most attractive wild flowers. The dog-tooth violets (Erythronium) of the Eastern states are represented in Northern California, and still further north by a number of species much finer than the Eastern ones. Some of these bear several large, white, yellow or lavender flowers on stems a foot or more in height, and are extremely showy.

Some of the Eastern wild flowers may be grown in California if one is willing to take sufficient pains with them, but they do not as a rule, take kindly to the climate of California. They miss the complete winter rest, and suffer from the long, dry summer. However, one is willing to take a little trouble to have these reminders of other days in the garden. I always enjoy seeing the first Hepaticas, and later the Trilliums and Ladies' slippers which recall to me the botanical excursions of my college days in Michigan.

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It is with great regret that we are forced to announce an increase in the price of THE NATURE-STUDY REVIEW from $1.00 to $1.50 per year, this new price to go into effect August 1st, 1920. Special prices will be made to clubs.

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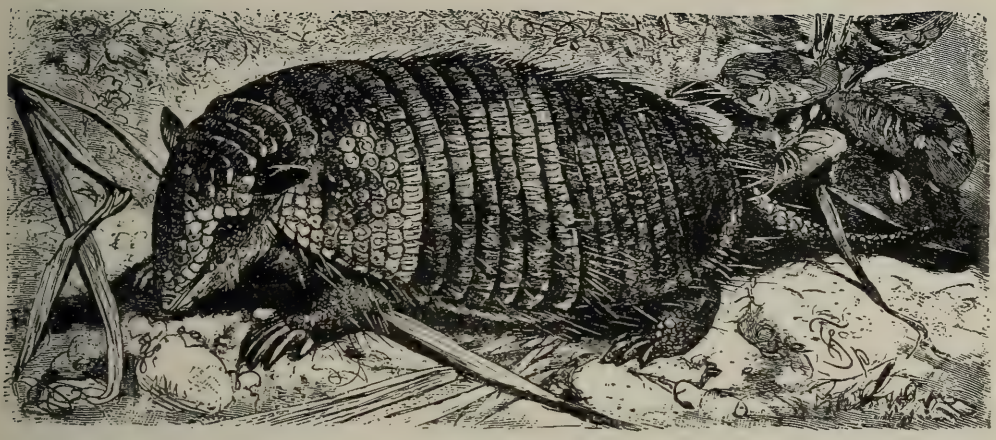

An Armadillo

Trouble with Two Tatus

JOHN C. BRANNER

Professor of Geology and Ex-President of Stanford University.

The most fun and the liveliest time I ever had with pet animals was experienced within the space of eighteen hours passed in company with a couple of armadillos, or *tatus*, as the Brazilians call them.

I was living in Brazil at the time, and bought a pair of half grown tatus of a countryman who offered them for sale at a railway station up country in the State of Bahia. The animals were securely enclosed in a stout box, and the owner told me they had been captured when very small, that they had been brought up in his own house, and that they were perfectly tame, and harmless, that they made very interesting pets, and when I got tired of them as pets, I would find them very good to eat. Though I had often seen such animals, most of them had been killed before I saw them, and I knew but little of their habits. When I first saw these two they seemed to be rather sleepy, but the owner assured me that they would be more lively and show off to better advantage as night approached. Subsequent events more than bore out his statement.

The box in which they dozed reached the house I was occupying at that time, and I at once had them out so as to get better acquainted with them. Being but half-grown they were hardly bigger than full grown squirrels, and for half an hour I felt that

they were far and away the most interesting, entertaining and wide awake animals I had ever seen, to say nothing about their being ' cute." It was some time before I could accustom myself to what was, to me, their unusual form and style of beauty. I could not look at them without laughing at what seemed to be their artificial and mechanical make up. They were protected almost all over by a natural covering of hard bony armor-plate that overhung so as to form a sort of roof-like projection along the sides. Even the legs, head and ears were similarly covered with these hard but somewhat smaller scales. The skin on the lower sides of their bodies was not so well protected, the scales being thinner and weaker, and a few coarse reddish hairs grew between the scales. On the whole they looked like some sort of joke on the part of nature—like freakish imitations of iron-clads or like gigantic stagy yellowish brown bugs, tile-roofed, or covered with horny shingles, and the strangeness of their forms was only accentuated by their activity and ease of movements. They were nervous, fidgety, interested in everything and everybody, and had an insatiable and fiendish curiosity about everything within their reach, which meant everything except only what was hung high on the walls or from the ceiling itself. For they were poor climbers.

They showed not the slightest fear of persons, but they were evidently pretty uncomfortable when dogs were about. At night they never stopped a moment, but went and worried like troubled consciences and never never tired.

They showed no disposition to escape, but I never knew whether this was due to their established domestic habits or to the fact they they had not yet explored all the unknown holes and corners about the place.

They were first turned out of their prison box in the small house of five or six rooms that I occupied with my traveling servant and cook. The walls of the rooms were plastered, but the floor was of hard tamped earth. Around the walls stood boxes of rocks and fossils, some of them nailed up, others open and in process of being packed, while loose specimens lay upon their labels on boxes, chairs and tables. Here and there were bottles containing alcoholic specimens, and chemicals used in photography, and empty bottles, and near by were trunks containing clothing, notebooks, maps, writing materials, cameras, and all the equipment required

for photography by the old wet-plate and dark-room process. Across one corner my hammock swung close to the floor.

The room adjoining was used as a dining room, and also used for a sort of store-room. In one corner of it were piles of bags of corn, and across another corner the camarada slept at night in a hammock. Against the wall stood a small trunk and on top of it stood a basket of clothes just brought in by the laundress. Next beyond was the kitchen with the usual train of pots and pans, tin ware, plates, knives, forks, spoons, water jugs, and all the rest.

In this new field for research my two tatus from up the country were turned loose just as shades of night closed in. My household assembled to see what novelty I had brought this time, and I was fully justified in my theory that they would all be either shocked or entertained, possibly both, by this my latest acquisition.

As soon as the tatus were out of their box they began a hurried but minute examination of their new surroundings. They overlooked nothing, whether person, place, or thing. There seemed to be absolutely no limit to their curiosity. To them a hole was a thing to be looked into, crawled into and explored, and that too whether it was big or little, wet or dry, crooked or straight, clean or unclean. They hesitated at nothing, and the examination had to be made right now I could not see that they did anything in particular except to catch a few insects. But, however funny they seemed to be at first. their curiosity soon had the whole household in an uproar, with many of our neighbors looking in from doors and windows. They crowded in among the bottles thrusting them right and left among the rocks and breaking several of them, they pushed my specimens about and mixed up the labels, they upset a camera that stood on its tripod, and while we were looking after that, they upset a bottle of ink and after messing about in it they burrowed into an open trunk and rooted about among the clothing until they had most of the contents out on the floor. They then ran through the open doors into the kitchen where they upset the tin ware, overturned and broke our two water-jugs and rushed madly from one spot to another until the cook captured them and brought them back to my room.

They then turned their attention to the people in the room. Finding some space between my legs and my trousers they proceeded to climb up inside of the trousers; taken on my lap they

got into my pockets and pulled out everything they could find, and then crowded down my coat sleeves. If I sat down where they could get at me they pushed down inside of my trousers from the top. And they never took "no" for an answer. If repulsed they came back, and they kept on coming back until they got what they wanted. They had no sense of propriety whatever. They seemed to think they owned the place and everything in it.

About this time a gentleman living near by called with his wife. The tatus were as busy as ever, and three of us were quite as busy as they trying to keep them out of mischief. But as soon as they found strangers in the room they at once began to take liberties that quickly sent the lady screaming into the streets. We didn't know whether to laugh or to cry at the indignity put upon our guests.

As a possible relief from the energies of our pets they were then turned out in the back yard where they seemed to be quite at home with the thorns, thistles and spines of the hedges. But ordinary country life seemed to have no particular interest for them, so they looked about until they found an open sewer, and they proceeded to explore that. Imagine my horror!

They seemed to have found at last something that suited them, and they didn't come back! After waiting awhile we gave them up for lost, and thinking our problem had solved itself we went indoors to straighten things up after the late orgy.

We had about restored things to approximate order when the cook rushed in gesticulating greatly excited, blazing with indignation, and consigning the tatus to the bottomless pit. They had come back from the sewer covered with filth, and had proceeded to burrow among the clean clothes in the dining room that had just come back from the laundry. Surely we couldn't expect decent people to live in the house with such scandalous creatures!

The tatus were captured and thrown into a tub of warm water, scrubbed pretty thoroughly with a broom, rinsed, dried off with a towel, and admitted once more to respectable society, but under protest from both cook and camarada, and strong suspicion from all parties concerned. It was now getting late, and in order to keep responsibility where it belonged I took the tatus in my own room, closed the doors, put breakables where they could not be reached by the pets, and went to bed, leaving them to nose about among the boxes and locked trunks as much as they liked. The

unusual noises in the room, however, and their occasional efforts to climb into my hammock, kept me wide awake, for though they could not break or tear down or turn over much, they could and did chase and race and scratch and claw without stopping for a moment, while my camarada snored in peace in the adjoining room.

Hoping to distribute my troubles somewhat I finally arose and as quietly as possible put both tatus in the room where the camarada was asleep, closed the door, and went back to bed. In less than ten seconds there was a terrible crash, and I heard the camarada appealing to the mother of all the saints, and consigning the tatus to all the devils in the infernal regions. I bounded out of bed and rushed to the rescue. The tatus had succeeded in climbing on the table and had crowded off on the floor a stack of plates and tin ware that made a racket fit to wake the dead.

Almost immediately they found the pile of sacks of corn piled in one corner of the room and began to burrow among them, and as they would make holes in the sacks and let the corn run out, the bags had to be taken down so as to get the animals out. The sacks were soon scattered in heaps about the room, and the tatus were finding new hiding places in the new piles, and the bags had to be moved again, and again the tatus found holes among them. It was soon evident that this sort of thing would never end, so we captured the two imps and turned a corrugated iron wash-tub over them on the floor, and pulled it up against the outer wall of the room. It seemed strange that we hadn't thought of that simple expedient before. We sighed with relief, wiped our perspiring faces, put a little stick under the edge of the tub so they would not suffocate, and a bag of corn on top of the tub so they couldn't turn it over, and went back to bed again.

Next morning the tub was so quiet that I was at first afraid my pets had died in the night. No such luck. They had burrowed out, escaped out of doors, and had again gone into that unspeakable sewer.

It occurred to me that I had had my money's worth of fun with them. They had certainly ceased to be a joke. It was evident that I must either part company with my two interesting pets or I should have to give up the rest of my life to getting them and myself out of an endless series of scrapes, and to repairing the damages done by them. And if two half grown young ones

could make so much trouble, there was no foreseeing what they might do when grown up, and when one of them would be more than a match for a man in the various pulling, scrouging, racing, and smashing contests they were sure to get into.

Across the street lived a family in which there was a boy nine or ten years old. He was leaning over the lower half of the front door when I looked out. I called him across the street, and asked him if he would like a pair of tatus: he grinned. I told him he could have mine on condition that he killed them and ate them that day. He promised to do so; and the last I saw of my two brown pets was a rear view as the bare-footed boy walked away with one under each arm.

I remarked to myself that the "hæc fabula docet" of this whole matter is that curiosity and vitality are liable to get young folks into trouble unless they are under proper guidance.

California

ALBERT W. SMITH
Acting President of Cornell University

Beyond the high Sierra's snow
The summer trade-winds gently blow
To cool a blessed valley where
The eucalyptus scents the sun-steeped air.

Tall redwoods on the mountains high
Are outlined 'gainst the western sky;
And eastward mountains, bare and brown,
At evening glowing watch the sun go down.

This valley when dry summer wanes
Grows green beneath the waxing rains;
And redwoods drip in mountain dells
Where manzanitas hang their tiny bells.

Then poppies flame on verdant hills;
Their fragrant air is cool and thrills
With songs of meadow-larks; beside
Lone ways shy mariposa lilies hide.

At Palm Springs with the Sierra Club

JULIA ELLEN ROGERS

Author of THE TREE BOOK, THE SHELL BOOK, TREES THAT EVERY CHILD SHOULD KNOW

I wish every reader of THE NATURE-STUDY REVIEW could sit here with me on this glorious, sunshiny spring morning, and gaze down over the rocky side of Palm Springs Canyon, see Mt. San Jacinto looming white over our shoulders, deeper hid in snows than for many years, its melting coat feeding the noisy stream that tumbles over the rocks in a tortuous course away down there in the canyon bed. About 100 members of the Sierra Club are scattered about, spending this Palm Sunday (as who could better?) among stately desert palms (*Washingtonia filifera*) in their native haunts. Like an avenue, winds the course of the stream, with sentinel palms lining both sides, each on a tall stem, crowned with green leaves in a globular head, each short-stemmed and with round blade, of the usual "palm-leaf", pleated pattern. Below the green crown, the leaves of past years hang brown and dying, thatching the upper trunk with their overlapping blades. Some are apparently twins, crowding as they have grown to adult size. The tallest are slender, the stockiest trunks are often almost covered to the ground with the thatch of persistent, pendant leaves. The young trees are as big-headed as their parents. It takes years of growth to lift these youngsters up and up. One hundred and fifty years old the "wise guy" says the oldest trees probably are. Nobody can prove him inaccurate in his statement.

The companions of the palms down there are willows and poplars brave in new spring foliage. Back in the sloping incline of the valley, there is good soil, the wash of the shaly foot-hills, and on it are thickets of bright green creosote bush showing abundant yellow flowers. Then comes the desert, an abrupt face of exposed strata; then another, and another till the eye reaches the skyline of the rocky ridge that keeps guard over the canyon of the palms.

With my field glass I look up the "avenue" of palms, to where the canyon narrows and its head is lost around a curve. In the opposite direction, the gateway opens into the broad valley, still desert in its vegetation, that stretches away northwest toward

Banning and San Bernardino, whence we came by auto buses yesterday. The warm sun and the abundant rains have brought out the wonderful desert flora. Far and near I see among the rocks on the sides of the canyon walls the barrel cacti, well-described by name. Blossom buds show among the spines on the top. Nothing could be more perfectly protected by Nature than this spine-covered capsule-shaped plant. The largest here are four feet high and two feet in diameter. By chopping out the top in a cone-shaped pit, and churning up the pulpy interior, the thirsty desert traveller can secure a cup of water very palatable, and utterly thirst quenching.

The vicious cholla, a bristly, branching cactus, soft olive gray in color, is a plant to avoid contact with on the trail. Its sharp spines are painful to the skin of humans, and they keep going farther in.

Among the cacti of many kinds are the Eucelia shrubs—the incense plants, a dome of olive green foliage set with an array of yellow flowers in loose spray held up a foot or so from the leafy dome, a delicate gold aura of flowers, of daisy pattern, hovering like flame over the bush, that looks as gray and rounded and solid as a boulder. Various sages add to the gray of desert shrubbery vegetation.

I would never have expected to find on the bleak mountain side flowers as delicate in texture and color as the hepatica of the eastern spring.

Before listing these herbaceous, dainty things, I have climbed to the crest of the ridge,—the hermit's cabin on the first ridge is a tiny thing, and automobiles at our camp at the canyon's mouth look like small black beetles. Half a circle of snow covered peaks are in my view. Yet the shadows of the boulders lie on beds of thick green moss; delicate blue flowered Brodiaea clambers up among the branches of a spiny shrub, satiny yellow-petalled California poppies dot the sides of the trail. The royal purple of the dwarf lupine, the indigo flowers of the wild canterbury bells are as beautiful and as large up here as along the stream banks and road-sides away below me. Clumps of the desert buckwheat are in bloom, the tiny flowers shaded pink and as delicate as arbutus in New England. Miniature white bells crown a plant an inch high. Another ambitious little thing, scarce any taller holds aloft a dozen green pods above a rosette of green leaves and a tap root of

microscopic size. Up here the pale pink wild hollyhock is larger than I saw in the valley,—plants three to four feet high springing from clefts in the rocky bank. The clumsy gray stems bear scarcely any leaves.

Coming down to camp I stopped to cut some of the hooked, horny spines of the barrel cactus to take to my nephew to add to his extensive line of fish hooks. Also a few straight ones to replace needles on the victrola. I found the cocoons of some moth safely hid in the furrows down the sides of this plant. How the winged form could emerge from such a prison, barricaded by the overlapping spines is a wonder to me. Fiddleheads, forget-me-nots, white and orange, daisies of various colors and sizes, tidy tips, stone crop (hen and chickens), peppergrass, yellow evening primrose, bed straw, and dodder, the tall tree tobacco, blue larkspur, bladderpod, with yellow flowers above the green fruits, and showiest of all along the trail are large, magenta flower cups of the hedgehog cactus growing on the sides of the club-like short stem. Each flower is two to three inches across the cup, which is made of many silky petals which close at night, and when the day is cloudy.

In sight from the entrance of this desert paradise are orchards of almonds and apples and oranges, on land stolen from the desert and made fertile by water from Mt. San Jacinto's snow reservoirs, led to the orchards from this dashing stream that sings to us on this lovely Sunday in Palmy Springs Canyon.

The Cypresses of Monterey

A. B. C.

Staunch derelicts adrift on Time's wide sea,
Undaunted exiles from an age pristine!
Your loneliness in tortured limb we see;
Your courage in your crown of living green;
Your strength unyielding, in your grappling knee;
Your patience in the calmness of your mien.
Enrapt, you stand in mighty reverie,
While centuries come and go, unnoted and unseen.

A Stanford Garden and Some of Its Tenants

David Starr Jordan
Ex-President of Stanford University.

Our house on the Stanford Campus stands apart from the other homes and encircled by a dozen superb white and live oaks. These trees, among the finest in the state, were preserved by a former occupant whose abode had stood nearby. One of them, a live oak, is of remarkable interest, being perhaps the largest and most perfect "woodpecker tree" now in existence, and bored full of acorn holes by the red-headed wood pecker, *Melanerpes formicivorus*. This bird, otherwise much like its eastern cousin, has the unique habit of thus storing in the fall the long slender live-oak nuts against the days of need during the dry season of California.

About the house we planted a great variety of trees and shrubs which ultimately grew into a crowded, incongruous, but delightful jungle. I resist my botanical impulse to name them all, notwithstanding the fact that their appellations are as honey on my lips and that nearly every quarter of the globe, equator and poles excepted, has its representative. Among them the Australian *Callistemon* ("Bottle-bush Tree"), the Minnesota crabapple, and the Japanese cherry stand first in my affections. From Christmas, at which time our spring begins, until June, when the fields grow yellow, the thicket is joyous with bloom. In the fall the flame-thorn with its orange berries tempts the white-crowned sparrows to earlier and earlier visits so that of late they leave not a bite for the robins who come in January, and who formerly regarded the thorns as their sole preserve.

Roses, of course, we have in abundance, with two beautiful climbers which cover the whole front of the house and around the garden extends a little orchard with a variety of fruit trees, set off here and there by several sturdy plants of the "Barbary Fig",* some of which were brought directly from Morocco, others from Luther Burbank's wonderful nurseries at Santa Rosa.

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*A cactus with agreeable fruit which although like every other species of cactus a native of arid America, has long been cultivated about the Mediterranean. The Barbary Fig forms the parent stock from which Burbank has developed numbers of interesting and valuable variants with red, white, green and yellow fruit.

The garden we cheerfully share with certain other individuals who seem to think it theirs. A large covey of quail surely have prior right, being "original settlers" already long established when we arrived. Finding us friendly, they decided to remain, roosting at night in the big trees, wandering around at will by day, a little shy to be sure, but confident nevertheless of our good intentions. And a beautiful sight it is to see the whole unit, young and old, briskly deploy across the open driveway and dart to shelter in the other covert. If, however, the house is quiet, they calmly take possession of the whole place. In the morning the male with tossing plume perches on limb or post, calling out (at least, so it comes to my ear) "thirty-two, thirty-two." But as a matter of fact, the real count of the covey runs above forty.

Other birds keep house with us,—the fine sickle-bill or western thrasher, a relative of the mocking-bird and almost as sweet a singer; many linnets, the male crimson-washed and with exquisitely sweet voice, as well as an inordinate taste for cherries; the little house wren; two dainty species of humming-birds; and the jay with wonderful sky-blue coat, but dreaded and detested by all his smaller neighbors because of his evil temper. Outside in the great field lives the western meadow lark with thrush-like notes, quite unlike the incomplete and querulous call of his eastern cousin. Mounted on a fence post, oblivious of the friendly passer-by, hour after hour, he lifts his ringing carol to the day.

In addition to our native neighbors, for many years I harbored certain interesting aliens for purposes of study. These were monkeys and parrots, for which the climate of California is fairly well adapted. Bob was the first and cleverest of my monkey people,—that is, we called him Bob. His real name we never knew; it was lost in the jungles of Borneo. But as I long ago told his story* for naturalists and for children, it need not be repeated there. Concerning the others of his kin who came after a few words will suffice.

One little ailing *Cercopithecus*, a member of Bob's tribe, was given the run of the warm furnace room which he shared with two kittens. Of these he became very fond, often sitting with an arm around each until they grew too big for him. And when his food was brought, he always carefully laid before them some

*"The Story of Bob". "The American Naturalist," 1892. Reprinted in "The Book of Knight and Barbara."

delectable morsel, such as a cold potato or a raw carrot. These they finally came to accept, though not enthusiastically, while he in return learned to lap up milk, cat-fashion.

All of my simian wards were human in their longing for companionship. One big female grabbed a passing kitten and made off with it to the top of the barn. From that point of vantage, she was dislodged with difficulty after an hour or so, during which she hugged the whimpering little beast to her monkey heart. At another time she adopted a young motherless chick, and as night came on would carefully lift and place it out of reach behind her in a snug corner of the old dog house where she slept. At sharing her food, however, she drew the line, gently but firmly removing her charge to a satisfactory distance at dinner-time.

Still another, a male who maintained a more or less mutually aggressive relation with our Great Dane dog, would when attached to the latter's collar by a chain ride around contentedly on his back. This amusement ended in a near-tragedy, for one day when the carriage left in haste to meet the train, the dog went too—so perforce did the rider, but not keeping his seat. We understood afterward that the scene was lamentable, but only at the station was the situation uncovered to the coachman. Coming back the monkey rode on the front seat, considerably the worse for wear, his eyes eloquent with reproach.

Of the parrots our special joy was "Loro Bonito," a yellow-head from Mazatlan. When given to us, he was able to imitate with a good deal of exactness the fife and drum of his home Presidio. This accomplishment he soon lost, however, and with it ultimately all of his Spanish, but he meanwhile picked up a good deal of English. From an Irish maid he learned to sing with strong Hibernian accent, "I'm called Little Buttercup, sweet Little Buttercup, though I could never tell whoi." The "Stanford yell" of those days with its eight "rahs" he worked hard at, but for a long time without arithmetical precision. One day, however, when the University was rejoicing at the lifting of a great cloud he listened intently to the reiterated student shout

Rah, Rah, Rah,
Rah, Rah, Rah,
Rah, Rah,
Stanford!

and from then on kept the count perfectly. Sitting in the sunshine at the end of a great oak limb, he took special joy in shrieking out the staccato lines again and again.

Our Guatemala parrot with the green head never learned to speak, but was greatly interested in music. When left alone in the room with the graphophone, he would strike the key and keep up a creditable running accompaniment of his own, but occasionally losing the note he would break out into a most discordant squawk—with which, in fact, he generally closed his performance. Another parrot of a different species (owned by a little girl from Guatemala) would solemnly repeat long Latin responses from the Mass, winding up gaily with "*Vamos a los toros.*"*

To the garden recently came two new tenants, less exotic than the monkey and the parrot, but by no means indigenous to California. The one is the Louisiana squirrel, much like the eastern grey squirrel, but smaller and with underlying wash of orange brown. Like all his brethren he seems to need an audience, and watches the spectator as though craving admiration. Between him and the cats there is a perpetual feud. Meanwhile the woodpeckers on their intermittent returns feel outraged by his raid upon their storehouse in the big oak and scold vociferously over his intrusion.

The Silver Squirrel of California, the largest and handsomest of our members of the tribe, is a shy animal, unfortunately, and never leaves his haunts in the upland forests. Our new friend belongs no doubt to the overflow from Golden Gate Park in San Francisco where his sociable species has been acclimated, and whence it is now making its way down the Peninsula.†

The other newcomer, the Opposum, is a beast of very different disposition, sullen in temper and sulking about by night, with no love for man and no human trait beyond a taste for chickens. Man in return finds him good only when properly roasted, Maryland style, under which circumstances he has much the flavor of a sucking pig. Native throughout the Southern states, this interesting creature is finding for himself a congenial home in our region to which some one has purposely brought him, with an eye to future "possum roasts."

*"Let us go to the bull fight."

†With all forms of this type as well as some others in America, certain individuals are melanistic glossy black throughout and exceedingly handsome.

Four Poems by Irenê Hardy

THE LITTLE BRUSHBIRD

Thru the little wickets,
  Between the gleams and glooms,
Of the manzanita thickets,
  I peer into the private rooms
Of the little brushbird, where she plumes
Her feathers brown and gray
  Silent at the dawn of day.
I watch her and her little neighbors
At their early breakfast labors,
The while I hear the pipes and tabors
Of the pheasants, orioles and larks,
Mingled with the robins' pert remarks;
And half aware I hear, I hear
The thrushes' lyric sweet and clear.
But none of these are half so dear
As the little brushbird ,brown and gray,
Silent at the dawn of day.

IMPLICATIONS

This is the birthday of the rose
  And of the robin's darling brood,
And yonder flowers with the pose
  Of lilies in their loveliest mood;

'Tis the birthday, too, of the butterfly,
  Bursting at length from her jeweled cell;
Go search out all that these imply,—
  No greater thing has earth to tell.

IN THE SONG OF THE THRUSH

I heard a thrush
Singing in the evening's hush,
And tho the day had been darkened, I knew
That somewhere the sky had been blue,
And that everywhere life had been true
To the note in the song of the thrush
In the evening's hush;

And I knew that my inmost thought
Greater faith for itself had wrought
From the song of the thrush
In the evening's hush;
For I heard as 'twere the very word
Of the voice there was no denying
Of One in the wilderness crying
Thru the song of the thrush
In the evening's hush.

THE DAY-LILY: A CHILD'S CONFESSION

Dear God, I found a flower to-day,
Out on the hillside where I play;
And Oh! it was so beautiful
I was afraid and ran away.
But soon I thought it would be right,
If I should fold my two hands tight
Behind my back, and look again,
For so, I could not touch it then.
And it was there and all alone!
So beautiful, so beautiful!
And I should think, since 'tis your own,
You'd plant it by your great white throne
So it could never be alone.
It is so beautiful, so beautiful!
Now into my bed I'll creep
And when I lay me down to sleep
The little flower and me you'll keep,
And I can come and look again
It is so beautiful, so beautiful! Amen.

The California Nature Study League

C. M. Goethe
Sacramento, California

An overseas letter arrived. It was signed "The Wasp Professor." This nickname was given its writer in a western orphanage. He had entered that orphanage from the Juvenile Court. In the court chambers the Nature-Study class leader had plead for one more chance for him. The judge, regretfully granting it, said further effort to reclaim the lad was useless, that he belonged to the "sewer of humanity," that "the sooner that such folk rotted, the better."

The letter proved the Judge had been mistaken. The lad, now grown and an airman in France, had written it. He described the great waves of seemingly resistless volume that continued breaking against the allied lines, in spite of a merciless machine gun fire. The epistle ended with these words: "The situation is desperate. Today we were allowed to fly unusually low over the attackers. So far I have escaped. Will I live to see which of the two ideals involved in this war will conquer? It all seems queer. Here I am, fighting for the right. A few years ago, by the turn of a hand I would have gone to the Reform School. It all came through that Orphanage Nature Study Class, when I had the chance to show that I could lead boys in decent things as well as in petty crime."

This dramatic letter shows the value of Nature Study in dealing with the plastic minds of children and adolescents. The "Wasp Professor's" life tale, changed sufficiently to hide his identity, is one of several which, accumulating, resulted in the concept of the California Nature Study League. The Orphanage was a laboratory. Years of child study there were broken by several journeys abroad. From all this came the concept of internationalizing recreation. Nordic, or blonde Europe's best contribution to the world's recreation culture seemed to be the Nature Study Field Excursion. Its use in Denmark included teaching even the children in Schools for the Blind the music of wild birds despite their inability to see them.

The California Nature Study League thus came into being. Its purpose was to transplant into California this highly organized Nature Study Field Excursion of Nordic Europe.

Its first attempt toward this was the publication of a monthly bulletin. Each bulletin describes one incident in nature's ever-revolving calendar. One of the first covered the thrilling "wedding dance" of Anna's hummingbird. Timely subjects, such as this, are chosen which can be found on any current Nature Study Field Excursion. The bulletins, utilizing the thousands of branches of the California County Library System, link out-of-door happenings with the treasures that are in books. For example, children enjoy tales of plant families, wherein the Jimson weed is discovered to be a "cousin" of the tomato that makes a salad attractive, and of the potato that comes so regularly to the dinner table.

The first issue of the bulletin was 50 copies. In May, 1920, its circulation will be about 5,000. It goes to centers throughout California. From each of these Nature Study influence radiates. One of the League's aims is its gradual duplication in every American state.

These stories are written for children. Out of their publication has grown other activities. Space permits mention of only one, the extension of the idea into nature guide work at summer resorts. The California Fish and Game Commission has charge of the conservation of wild life in California. Several years ago the League discussed with them the conservation possibilities of educating young Californians as to the unseen miracles of the out-of-doors by such nature guides. It argued that on vacation people are receptive to things in nature at other times unseen.

The concept was promptly translated into action at three widely different California resort centers. The test proved unexpectedly successful. The next year the work was undertaken on a more extensive scale at the string of resorts surrounding Lake Tahoe in the Tahoe National Forest. A preliminary publicity campaign was conducted from November until June. During this time stories of the unique, often almost arctic, fauna and flora of the high Sierras were published. These reached nearly one million readers.

Following this, Dr. Bryant of the University of California, assisted by Dr. Loye Miller, the Los Angeles biologist, went from resort to resort at Tahoe. They conducted Nature study excursions for adults. They led nature study games for children. These including the "herb smelling" and "bark feeling" games. At the evening camp-fire were talks, movies of wild life, lantern

slide lectures. Fallen Leaf Lake Auditorium was so crowded that late-come listeners stood outside at doors and windows. Meantime the League maintained free at each such resort modest Nature Study Libraries. These enabled guests to check up their field work, whether with mammals, birds, insects, wild flowers, or trees.

The Tahoe experiment discovered a real human hunger for such knowledge. Even the typical "tired big business man" dropped trout fishing for this other phase of the return to the primitive.

Director of National Parks Stephen T. Mather was an interested observer. He has always given generously of his private fortune to advance the best use of national parks. This year he has underwritten an enlarged program for Yosemite National Park. It seems probable that the movement, by its own gravitation, will extend to all American national parks.

Meantime, the first effort, the radiation of the bulletin, continues. The expense is slight. Obtain some scientist to write the bulletins. Have soneone with a newspaper "nose for news," reduce them to newsy form if, as in California, the bulletins are to be published regularly in newspapers and in magazines. Then comes printing and distribution by a good public stenographer with an addressograph.

The California Nature Study League believes earnestly this experiment makes for better citizenship.

Scientific education, in this sugar-coated form, tends to lead the young to see accurately, to think clearly. Those who thus acquire accuracy of vision and clarity of thought, on becoming citizens, will be largely propaganda-proof. Nature Study work, therefore, tends to protect our American democracy against noxious propaganda from countries where medieval European ideals dominate.

Again, the expansion of this nature study in city schools, results in attracting children and adolescents out of the city environment into the health-restoring out-of-doors. Within urban areas recreation only too often takes the form of commercialized vice. The League's work builds habits leading city dwellers toward salubrious roadsides and by-paths. Such work is an antidote for certain poisons, the supply of which are largely increasing with the rapidly intensifying congestion in cities.

Two sources of such poison have indeed recently been removed by legislation, the saloon and the brothel. Even here Nature Study helps. Both saloon and brothel were social centers. We have a responsibility to offer acceptable substitutes. The Nature Study Field Excursion offers, without prohibitive cost, just such a substitute.

All this Nature Study makes for a sturdier citizenship. America needs a citizenry trained to see clearly, to think accurately, to play healthily. Anything that assists to promote both clean recreation and popular interest in scientific education, makes for a better world in the generations which are to follow.

Song of the Meadowlark

CARROLL DEWILTON SCOTT
Pacific Beach, California

Greetings merry meadowlark!
  Warbling whether sun or rain
From the dawning until dark.
  How I love to hear thy strain!
Always pealing happily
  "Life is very sweet to me."

Every bird is glad in Spring,
  Yet in August thou art gay
And thy golden warbles ring
  When December skies are gray.
Is it thy philosophy,
  "Life is very sweet to me?"

Or the truth perchance is this:
  Dwelling in the meadows wide
Where the breeze and sunlight kiss
  Grasses into summer pride
Life must needs be "sweet" to thee
  Dear apostle of the free.

When I linger in thy meads
  Where the luscious odors flow,
Little use have I for creeds
  When the winds your meassge blow;
  I too, whistle gleefully
  "Life is very sweet to me."

Old Man Coyote

CARROLL DEWILTON SCOTT
Pacific Beach, Californa

Across the hills I hear your wistful tale,
A friendly bark and then a lonesome wail
Along the canyon's immemorial trail
  Lonely and drear
Where I have oft surprised you, seen you wend
Your way back by daybreak or at twilight's end
And in the brown embracing mesa blend
  And disappear.

To some your voice is of a coward-knave—
Your weird cry—or a maniac's rave,
Shriek of the damned, no pardoning can save
  Or penance free;
Unhappy soul forever lost to mirth,
Spirit unduly hastened from the earth—
The murdered maid, the child of evil birth—
  Not so to me.

I understand. For your old friend you call
The primal Red-man whom you love, and all
The adventures of the camp, things that enthrall
  The smell and sight
And draw you closer to the dying fire
To share the kill when frosty stars climb higher
Or moan with him about the funeral pyre
  Far in the night.

Aye, are you not his potent medicine-man?
Master of cunning since the world began,
Bringer of fire, clever artisan,
  Hero-Deity?
Alas! the white man drives you both away;
But where the pagan altar once had sway
You keep your nightly watch and faithful bay
  His memory.

Again the old familiar paths you thread
Barking your greeting, listening for his tread,
Wailing your lonliness—his fire is dead,
  His camp is still.
Yet faith in your Big Medicine abides;
Your laugh the usurper's power derides;
You plan revenge as twilight shadow hides
  The western hill.

Mount Shasta Camp for Nature Lovers

Bertha Chapman Cady
Instructor of Nature Study, in Chico Normal School

Of course you have looked at the pictures. Is there need of words to convince you that here is, indeed, a paradise for nature lovers? Mt. Shasta Camp is located on a small stream, formed by one of the great, gushing, contributory springs which feed the upper valley of the Sacramento River.

The spring, from which the Camp is supplied is fed by Shasta's everlasting snows and bubbles from beneath deep beds of volcanic rock at the mountain's base. Here in its spray the water-ouzel dips and dives feeding on the great wriggling larvae of the stone-flies which he triumphantly brings to the surface before eating.

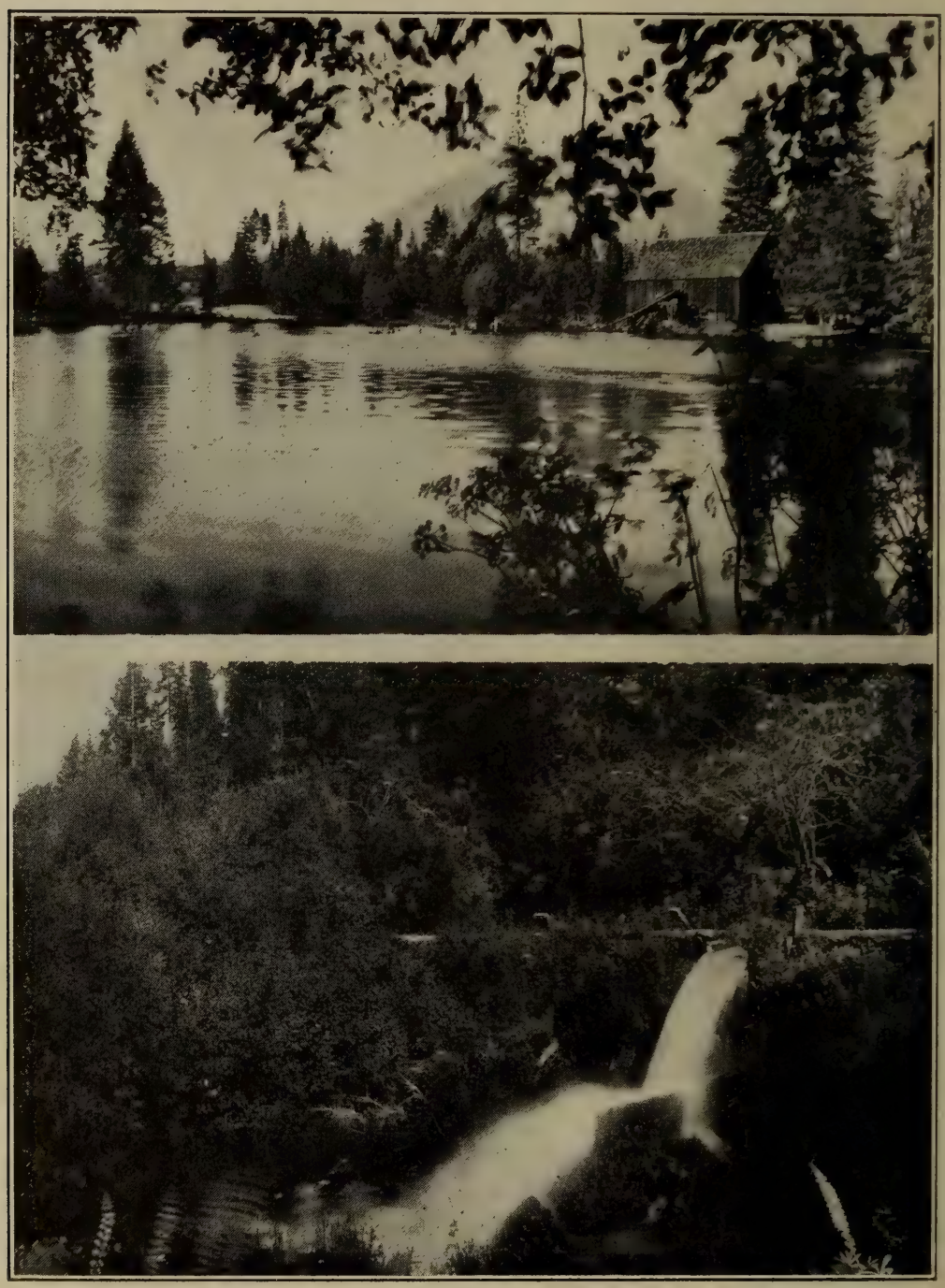
The tents gleam white from a thicket of young Douglas and silver firs, pines, both yellow and sugar, incense cedars, and oaks. These trees also offer shade for cots and hammocks through the drowsy hours of midday.

Beneath the shelter of these same groves, classes gather in informal groups. A circle of trees whose interlacing branches admit the scented breeze and the glint of sunshine, where the birds come to sing and build their nests, where butterflies flit through and flowers bloom at the very door, make a class room well adapted to nature study.

Above the Camp and off to the East rises Mount Shasta, serene, majestic, holding high her snow-laden crown now veiled in violet mists again quivering and sun-drenched beneath the noon-blue sky. Shastena, the lesser crater, shoulders close against the mountains' western slope while in strong contrast with their heavenly whiteness looms the Black Beetle cinder cone farther to the north.

Velvet green meadows, flower flecked, and forest shaded stretch away through the valley, broken here and there by mountain streams and limpid lakes, the home of wonderous trout.

The western wall of the valley is formed by range on range of level mountains less majestic than the eastern mountains, yet richly clothed with forests and myriad blossoms. This Mount. Eddy region holds in our memories the place of rare days and flashes of rich color of friendly flowers; daisies, larkspur, columbines and castellejas and pentstemons, with the mysterious pitcher plants, lady slippers, orchids, tiger and Shasta lilies.



Upper view: Black Butte in distance
Lower: The spring where the water ouzel dives in the spray
Photo by B. Cady

Do you glimpse the meaning of all this for the lovers of out-of-doors? Vast, ever changing mountains rising above dark forests of Shasta firs and mountain hemlocks—long levels of sunburned chaparral, rich valley meadows, forests of cone-bearing trees, lakes and icy streams, with flowers, flowers everywhere. What, I ask, is wanting to make the Nature lovers' heart sing from dawn till dark?

Need I say more of what our nature study classes mean than just this—we try to get better acquainted with our out-of-doors.

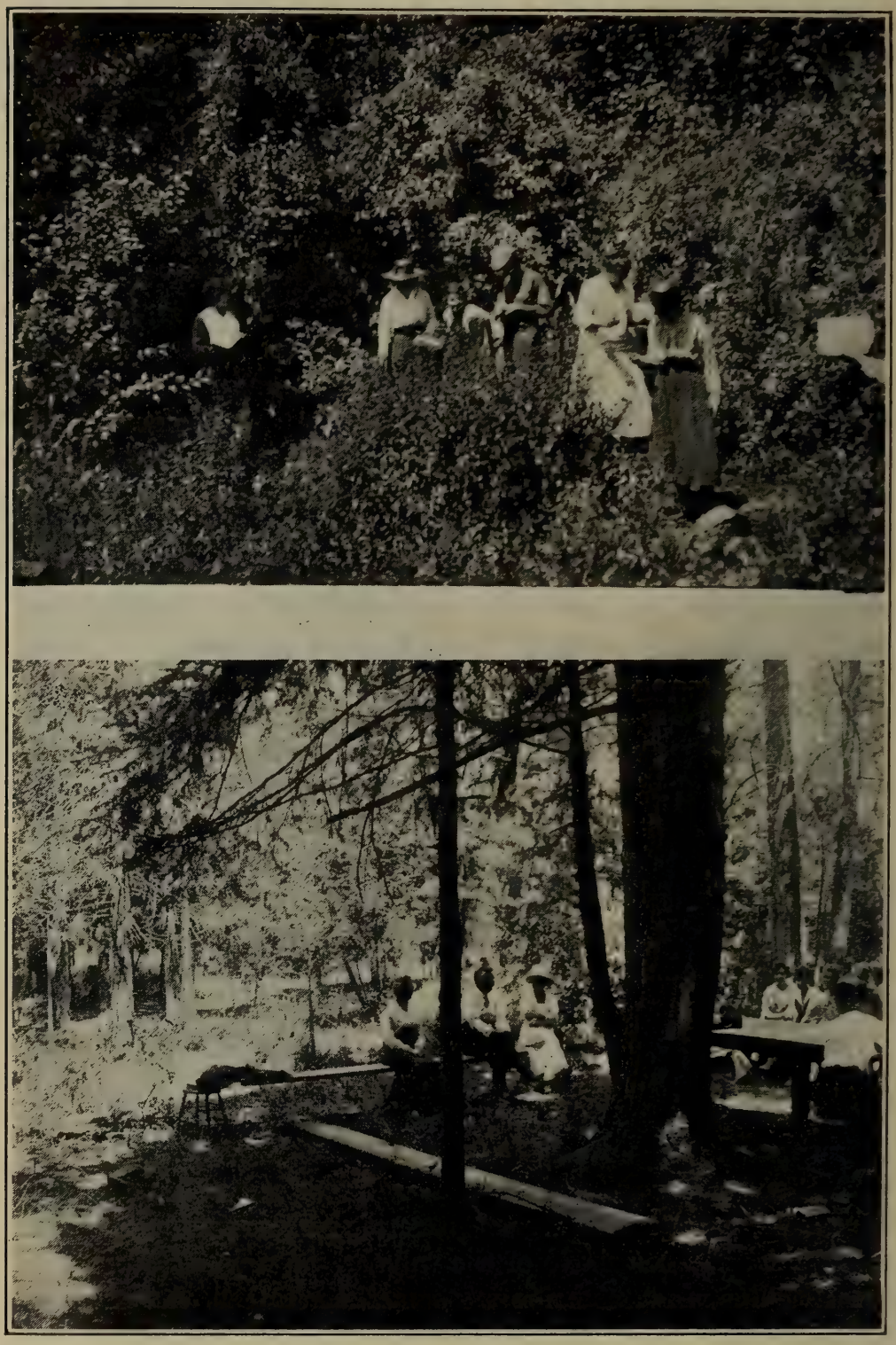
Nature is all about us, entering at every threshold. At night through the open tent or the cot beneath the trees with only God and the stars above. At dawn when the great silence holds the veiled mountain. In the pulsing sun-gold of mid-day, broken only by the stinging song of the cicada or the icy splash of the cascade. At the end of the busy day when we gather beneath the dome of incense cedar boughs lifted on the shafts of ruddy-purple to listen, perhaps, to the "Butterfly Lady" tell of her wanderings through many lands net in hand and love in her heart for the beautiful winged "blossoms of the air–"—or to listen to music through the stillness and the sifting sunbeams.

Here, we study, dream, and play, sometimes alone, if we will, again together for the interchange of ideas and ideals.

Slipping away from the heat of the lower Sacramento Valley, the State Normal School at Chico decided there could be no better place in northern California for its summer school than here at the base of Mt. Shasta. Through the generous cooperation of the citizens of Sisson a permanent camp has been estabished and when June comes it is "hi, ho, for the mountains!"

Regular courses, helpful to teachers, are offered and naturally in such a setting nature study forms no small part of the joy of camp life.

The work itself is quite informal. Classes are held out in the field wherever anything of interest attracts our attention. We wander down to the spring, each gathering what is new and promising to him. In the shade of the willows, we sit and talk things over together, each contributing something in the way of questions, information or suggestions for further investigation, the teacher acting as guide or helper only. The spirit of nature study and ways of presenting and developing the subject are brought out in this actual work in the field.



Upper view: The work is informal and determined by the things we find in the field

Lower view: Beneath the shelter of the groves, the classes gather in informal groups

Photo by B. Cady

Sometimes a careful piece of observational work is done by each student again it may be given a game of trying out all the senses to see how many things each can find in a given time. Often the lesson is determined by the discovery of a junco's nest beside the trail, a towhee's family in a thicket, by the stream, a city of termites in an old decayed log or a struggling solitary wasp mother, dragging home her prey. Crouched close about her hole in the ground we watch, breathlessly, as she pulls the deadened caterpillar into her pit and lays her egg, out again to fit and fill the opening with perfect skill. At times we give ourselves to watching a woodpecker at work, a nuthatch searching the tree trunk for insects or listening to the call of the jays. Another day we spend with the butterflies in the meadows beyond the stream, great swallowtails or white spirit-like flutterers looking like stray snow flakes hovering about the topmost branches of the dark green firs. Again it is a day with the fairy realm of ferns and mosses. Nature's "gentle love tokens" which grow in every crack and cranny apparently forgotten by the other plants.

Enough, perhaps, to suggest what we do about Camp yet there are the longer trips as well. The long tramp up to the mountains itself takes us from the valley flora through various plant zones to timber line and others on the naked rock ridges—from Nature at her friendliest with luxurious masses of tiger lilies and orchids to timber line where only crouching, storm-beaten adventurers meet Nature at her harshest. The Alpine flora of Mt. Shasta is disappointing in its richness. It is reserved for the Mt. Eddy trip to thrill us with glory of color and above all to show us our first patches of marsh land out of which the Cobra-like heads of Darlingtonia pitcher plants lift themselves to the sun, the ogres of the plant world. Another trip that takes us to the titanic chambers of Pluto's lanes, formed by the bursting bubbles from the age old volcanic days when Mt. Shasta burned. With candles held high we form a long procession through the monster chambers startling the bats and light-footed mice from the black nooks and cracks which have long lain in deadly stillness. With these or with the walk to Summit Lake or the scramble over Sunset Hill, or away to the falls of the McCloud River or to the great fish hatchery at Sisson, where you will, nature students are busy with new sights, new inspirations, new stimuli and are sure to take home better health of body, mind and heart.

A Strange Pet

Snow Longley
Los Angeles, Cal.

One day last spring some of "our boys" captured a weasel on the school-grounds and with some difficulty deposited him in a cage in the nature room. At first he was very much terrified, barking and lunging at all who came near, but in a few days he became accustomed to his strange surroundings and would even climb up his cage to greet me when I came to feed him and put his house in order.

At the time of the summer vacation the weasel was taken to my home and, with more leisure at my disposal, his systematic training began. In taming him my one principle was that, in compensation for his lost freedom the little creature must find his small environment a friendly world, and despite the lingering protest of ancestral brain cells he grew to accept my philosophy. One night when a stray dog came growling and scratching uncomfortably near, he jumped out of his bed and hopped up and down the edge of his cage, crying like a baby. After I had driven the dog away, I soothed the weasel with my voice till he went comfortably back to bed, never stirring till morning though his ancient enemy returned several times during the night.

I fed my pet raw meat and eggs till I discovered by chance that he craved milk. After that his regular diet was milk, usually with a little raw egg beaten into it, cornflakes and occasionally meat. He was a small and very dainty eater, lapping his milk even more deliberately than a cat, pausing at times to masticate carefully a flake of corn, and taking his meat from between my thumb and finger. If he did not want to eat at once what I gave him, he would hoard it in a corner, regardless of Mr. Hoover, and come back for more.

"Mr. Weasel" grew very fond of petting and would stretch out in lazy comfort or cuddle closer when I stroked and caressed him with both hands. His response was in licking the fingers of those he liked, stretching out his little paws and most of all in the eloquent look of his bright eyes. He liked to play too, and would sometimes near-bite, putting his sharp teeth against your finger instead of his tongue, but never pressing hard. Another of his games was to hide under the newspaper carpeting of his cage and

make little lunges, sticking out his head at unexpected quarters. When he was discovered, back would go the little nose, and in short order out it would pop on another side quite in the manner of the old song.

Besides the expression of affection, the weasel had several ways of showing his feelings. At the time of his capture he emitted an odor painfully suggestive of an unsavory family connection, thereby producing consternation alike in the hearts of his captors and of the white rats who chanced to be his neighbors in the nature room. This was the terror signal and occured only when he was startled, not more than half a dozen times during our three months' acquaintance. Contrary to one authority that I read, I can testify that this odor was not prevalent in hot weather.

The fighting instinct found expression in the shrill metallic bark which accompanied his lunges at a supposed enemy. Gradually the barking became a thing of the past. His most pleasing communication was a little quizzical, throaty sound, half growl, half purr, which denoted a slightly perturbed state of feeling. These sounds with the crying at the approach of his nocturnal visitor are, to my knowledge, the sum total of weasel language. But with "Mr. Weasel" as perhaps with greater geniuses, oral communication was merely an outward expression of an inward unrest, and with peace of mind he lapsed into sympathetic silence.

My bed is on a sleeping porch, and the most convenient place for my pet's home was the other end of that porch, so I had exceptional opportunities for observing his daily habits. His bed of excelsior had to be carefully put into place with his nose and paws before he retired for the night, but he was always grateful for a little assistance from my willing hands. When he had occasion to leave his bed, he always jumped out carefully so as not to spoil its arrangement. He got up regularly early in the morning, scratched and stretched himself, took a drink and made ready for the day. Then he would get back into his nest for a general toilet. His pretty fur, brown on the back and yellow underneath, with black markings on the face and a black tip to the tail, was always kept in immaculate condition, and his slender, sinuous body, long tail, rat-like head and shining dark eyes presented an attractive appearance after one had become accustomed to weasel standards of beauty. His personal habits were as particular as was compatible with his confined life, and his bed and the adjacent

spaces to the farthest corner of his cage were always perfectly clean.

He had become so tame that I had grown a little careless of locks and bars and was seriously planning to give my pet the freedom of the porch when the fatal day arrived. The cage was on the lawn at the back of the house, where Bright Eyes, as I finally named him, spent the sunshiny hours of each day, when in a reckless moment I determined to give him some needed fresh water. In the adjustment of door and dish the weasel simply slipped past my clumsy fingers and found his liberty. Fearing a bite or even more that a hasty move would startle him into actual flight, I scorned coercion, hoping to lure him back with the bait of food. Before executing my plan however, I turned to close a yawning gate, and when I looked back my little pet was gone forever. I heard of him in two adjoining chicken-yards, in one of which he escaped a gun through neighborly consideration rather than by his own cleverness; but he soon went father afield, and I left his cage door invitingly ajar and offered a reward for his recapture in vain.

I have missed him with a grown-up capacity for a childish affection, but it is a comfort to remember, although it makes me feel colossally stupid, that even outside his cage my little wild friend had absolutely no fear of me and that he strolled to liberty almost across my lap, looking back in comradely fashion before he plunged into the great world.

In that unknown or at least forgotten bourne, I fear his career was brief, Incapacitated by my sheltering care to face the struggle for existence, his little life was doubtless short, but I hope it was a merry one. I hope also, if it is not asking too much of fate, that he somehow mercifully escaped fear, but that he robbed at least one chicken-roost, danced in the moonlight and won some lady weasel, charming and graceful as himself, to be his bride before the end.

His little cranium had not room for many associations of memory, so I suppose that in the thrall of instinctive passions he quite forgot our sojourn together. But for myself, whose life is longer and perhaps not quite so merry, I shall always remember my little wildwood visitor with a very real affection and treasure the lessons of adaptability, contentment and trustfulness which he taught me.

General View of School Garden, 61st Street, Los Angeles

Agriculture in the Elementary Schools of Los Angeles City

CLAYTON F. PALMER

Supervisor of Agriculture and Nature Study, Los Angeles, Cal.

The Agriculture Department was established in Los Angeles City in 1912, and has enjoyed a steady, vigorous growth. At the present time it is composed of a supervisor, four assistants and about forty teachers, all of whom spend full time in teaching agriculture. In addition to these, there are a number of part-time garden teachers, who look after the gardening at their schools besides their regular grade work. The city maintains over one hundred school gardens, sixty-five of which are in part or wholly on borrowed ground. With one or two exceptions, no rentals are paid for use of such land. Over thirteen thousand pupils are receiving regular instruction in school gardening, and many others receive such irregularly. Fifty schools have a teacher two days a week, twenty-six schools three days a week, twelve schools a teacher one day a week, and as indicated above, several schools are in charge of a regular grade teacher.

While the department has a definite course of study, this is used more as a guide, the work in the different schools differing

*This article was held over from The School Garden Number of THE NATURE STUDY REVIEW.

considerably, according to local needs. Usually the work begins with the fourth grade, continuing through the eighth. The average number of pupils in our classes is 15, and the average length of time spent in the subject is about one hour per week. Our gardens vary in size, from plots the size of a city lot to over an acre in extent. The school garden is usually laid out with broad borders given over to the growing of shrubs, flowers, bulbs, etc., while the center is divided into large community plots, which will average about 600 square feet. In some cases, where plenty of land is available, the older pupils are assigned individual plots. Many of our gardens, even on borrowed ground, now have representative fruits planted upon them towards the rear. In many cases, these trees were produced in the garden.

Practically all of our gardens are provided with cold frames with lath covers, many with tool houses, some with hot beds and about 47 have lath houses. In two schools, largely through local initiative, we have glass houses. Our standard lath house is 16 x 24 feet, with side benches and a strong center table. The benches are used for cuttings, seedage, work with flowers, trees and shrubs, bulbs, and storage; also for potted plants for school rooms or material undergoing growth for repotting. During the past three years, through summer schools, we have have carried our garden work through the entire year. This arrangement has made it possible for us to undertake and carry through to completion many phases of gardening, otherwise impossible of success. In many cases teachers are able to carry on simple experiments in the school room, with soils, seeds, flowers, and other portions of plants. Many of our more recent school buildings have fairly well equipped agriculture and nature study rooms.

Our purpose in teaching gardening is to afford our pupils those experiences which will make them familiar with the art of producing plants successfully. We look upon the school garden as a practice and demonstration center wherein the pupil learns the many various processes necessary to successfully produce plants. The crop in our estimation is secondary to the experience and habits gained in the work. We encourage home gardening in every way possible, and have found the U. S. S. G. organization very helpful in the prosecution of this work. Many of our teachers are employed through "continuation" work, after school, to supervise and encourage the home gardening, being paid a fair

amount for such service. Then too, our cold frames yield thousands of plants which find ready acceptance for use in home gardens. This enterprise is also fostered by exhibits of home grown produce and small stock, held at the school usually late in the spring. The course of study is so arranged as to correlate the actual garden work with the fundamentals relating to soils, insects, diseases, the parts of plants and their functions, plant propagation, plant improvement, plant food, fertilizers, etc. It is our practice so far as feasible, to produce in our school gardens as part of our working equipment, different kinds of plants—flowers, bulbs, fruits, vines, etc.—which are not only desirable in themselves but which also serve the purpose of illustrating some specific principle in plant production.

In the lower grade are planted a few quick growing and easily produced vegetables and flowers; the next grade attempts the growing of forms a little more difficult; the sixth grade produces more flowers and takes up simple plant propagation; the seventh and eighth grades go into the subject of production of shrubs and trees, ornamentation of home and school grounds, insects, diseases, discussion of plant improvement, budding, grafting, etc. One plot in each garden is given over to the production of fruit trees and vines—fig, grape, quince, pomegranate, mulbery, plum, peach, etc. Many gardens produce representative fiber plants and cereals in season.

The produce from the gardens is marketed in different ways. depending upon the character of the district. It is taken home by pupils, is used for children's penny-lunches, by school cafeterias, and is sold to nearby homes, etc. Teachers are permitted to secure a small emergency fund through the sale of not only vegetables, but extra vegetable plants or ornamental plants. They are required to keep an accurate account of receipts and disbursements, to be reported upon yearly, to the supervisor. It is our hope that the garden teacher will become the agricultural adviser for the homes of the school community, and this is actually being accomplished in many cases, some of our teachers conducting demonstrations in pruning, culling of poultry and related problems, in the homes of the district. The opportunities along this line are many, and the school should rise to the occasion. The department maintains a two-acre Center, which serves as a school garden for five surrounding schools. It is in charge of an assistant

supervisor, who with two half-time teachers, instructs about 400 pupils per week. It also affords our teachers ample opportunity for securing practice and help along various lines of elementary agriculture. This Center maintains a trial orchard, a goodly variety of fruit and nut trees, nurseries, collection of ornamental shrubbery, cold frames, hot beds, hot houses, lath houses, pigs, chickens and rabbits. The Center furnishes seeds for elementary schools and is actually producing a large part of the ornamental trees, shrubs, vines, etc., now being used for ornamentation of school grounds about the city. A large portion of this work is performed by about 400 pupils incidental to instruction in plant production.

The agriculture department has the supervision of planning, planting and care of all trees, shrubs and vines on elementary school grounds. Pupils perform as much of the work as its nature justifies from the standpoint of educational value. The more difficult physical labor is performed by a practical gardner who is under the constant employ and control of our department. His services make it possible for us to extend help to our teachers as they need it, in doing the rougher work about gardens and grounds. This has been a great encouragement to the work, and as a result, more than 60 schools have lawns and over 100 have been permanently improved with trees and shrubs.

Agriculture offers the right kind of teacher wonderful opportunities, but one of our chief difficulties lies in the dearth of properly trained teachers of the subject. The department, during the eight years of its existence, has virtually been obliged to train its own teachers, chiefly after they entered the service. We have also trained a number of garden teachers as cadets at our Center, and a summer course in gardening has been given for the past three seasons. This situation is due to a number of things—the work is hard with compensation the same as for regular grade work, and the teaching of agriculture in elementary schools by special teachers is not nearly as common as it should be. Then too, our normal schools apparently excuse their neglect of this most important subject on the ground that the limit demanded for teachers of agriculture does not justify giving it the attention they do domestic science, manual training or art.

An Earthworm Elegy

ALBERT W. SMITH
Dean of Sibley College, Cornell University

I'm just a worm!
My sole resource to show my zeal,
Or make emotional appeal,
Is just to squirm.
The thrills I feel
I can't express in dulcet tones
With flashing eyes or sighs or groans;
I lack the organs these require;
And though I burn with passion's fire,
I'm just a worm;
I only squirm.

When April came,
And showers soft
Drenched sidewalks with delicious wet,
By thrills of spring I was beset,
And impulses to pirouette
Ran through me oft,
When April came.

I'm just a worm!
Alas, I lack
The lavish legs of millepedes,
Required for grace and springlike deeds.
What boots it then that I should yet
Burn with this rage to pirouette?
I'm just a worm,
Alas, alack!

In ecstacy
With springlike squirm,
O'er concrete on this April day
In pride I shaped my wiggly way.
When I launched forth in full career
I learned, alas, that men tread here.
Now half of me is just a smear!
Who started whole with hopeful squirm
In ecstacy.

I'm half a worm!
With shortened squirm,
Alas, though locomotion fails,
Yet here a crushed and smeary thing
My swansong squirming I will sing
With half a squirm,
A dying worm.

A Symposium of California Nature Stories by the Nature Students in Chico Normal School

CALIFORNIA, THE LAND OF HUMMIMG BIRDS

LILA SHEARER

California is surely the home of humming birds. We have six humming birds common to California and two others come to us as visitors while one species, the ruby-throat, is found throughout the East.

Though humming birds are small they are great fighters. I have seen them attack large birds like the hawks and blackbirds, and even outdo the quarrelsome English sparrows. They will even attack a human being who dares come too near the nesting site unless he has already made himself a friend.

With all their courage and pugnacity they are easily assured of one's friendliness. They soon learn to feed from one's hand or come for a bath in the spray held to water the lawn. Often they are attracted to come close if drawn by a gay colored gown.

It was long thought that hummers fed only on the nectar drawn from flower cups but, pretty as this fancy is, it has proven untrue for we know that they eat many small insects, both those sipped in with the nectar and those caught on the wing. Many long vased flowers are quide dependent on the hummers with their slender, needle-like bills for pollination.

Who has heard the humming birds sing? Yes, they sing though it is more like the note of an insect than a bird. They sit in the sun and squeak and "tsip" away most merrily and apparently quite to the satisfaction of their dainty mates.

The love making of these tiny birds is altogether unique. The males perform most remarkable "stunts" in the air before admiring the apparently unmoved females. With jeweled gorget spread the male bird springs in a wide arc back and forth before the female. Though she seems indifferent, we may be quite sure she is taking an occasional side-glance at this marvellous performance. Now he darts out into the air, flying straight up, until he appears no more than a bee, then turning, he plunges down at so great a speed one is certain he will dash himself to death or dash the little female to pieces. Within a few feet of the ground he wheels and darts again up, up and out of sight again into the blue.

When the mate is at last won the nesting site is chosen and building begins. A humming bird's nest—miracle of workmanship—is hung almost anywhere. We have found them in the branches of the tree or among its roots, now in a swaying palm leaf or among the bristling desert cacti. The nest building is apparently left for the female and how well she does her work is seen in any collection of these nests. Some are made of plant down ornamented with bits of lichen, leaf, and moss, others built of plush from the sycamore leaves and all held together with fluffs of the spider's silk or silken cocoons. The inside of the shallow cup is lined with down and tiny feathers.

When the young hatch they are no longer than bees and are naked while their black knob-like eyes and wide, yellow-rimmed mouths are then prominent features. They grow surprisingly, doubling their size in two days while in four days they are down covered. In twelve days features are formed and at the end of three weeks they are ready to venture from the nest which has become so crowded one wonders how they manage to stay in it at all.

All this has meant strenuous work for mother. She feeds them almost without pause and how she manages we often wonder. Standing on the edge of the nest, she stabs her long bill into the depths of the tiny birds until instinctively we look expectantly to find it piercing the bottom of the nest. However she knows just where to stop while we expect to see her lift her bill with the wee thing spitted as for roasting. Soon they are ready to care for themselves and dart away to add to nature's jewels.

California boasts of its black-chinned violet hummer, its green and ruby Anna, its leaf brown and copper Rufous and Allen, its Costa and daintiest of all hummers, the Calliope.

California's Tree Islands

DOLORES RILEY

Our California Coast is indeed interesting to the casual traveler and especially noted among tree lovers for its many local species. Most of these are isolated groups, found along the Coast of Lower California, and are known as tree or arboreal islands.

The Monterey region is one of the best known examples of such an island. Here we find the Monterey Pine, confined to a

very limited area of some five miles square. With it are associated such other limited groups as the Bishop's Pine, the Knot Cone Pine and the Monterey and Gowen Cypress growing near the sea-coast in small isolated groups.

The Monterey Cypress is, however, the tree which has attracted most attention on account of its picturesquely grotesque outline as it grows clinging to the outermost land limits of the coast. It is never found more than 350 yards from the ocean where it grips the cliffs in a desperate struggle with the violent storms which break on the coast rocks. Here this tree, remnant of perhaps vast forests of ages past, has taken its last stand. Unable to survive and spread its kind unaided, yet the Monterey cypress is, perhaps, the best known tree of California as it has lent itself readily to cultivation and through man's aid is spread throughout the world. It is used as an ornamental tree, hedges, or windbreak.

To the south we find near San Diego an interesting island of Torrey Pines found nowhere else on the main land and only one other group is known to exist and that is on the Island of Santa Rosa off the coast of Santa Barbara. The giant trees of California are too well known to need mention here and truly they are worthy of the admiration of every tree lover the world over.

Why should we as nature lovers be interested in these isolated groups? For themselves they deserve our attention for the light they throw on the geological history of our coast, and even though they are Californian they belong to the wealth of the world. They are protected for your joy as well as ours by the State and Nation and all too often the hurried tourist misses them just because no one told him they existed. You know now of some of our tree islands, come and see them for yourselves.

Mt. Lassen

Calley Boyle

Stately and haughty in her unique position as the only active volcano on the North American continent, stands Mt. Lassen, with her perpetually snow-crowned crest towering above her green clad neighbors of the Sierra Nevada Range. Perhaps less beautiful or of less stature than Mt. Shasta, her neighbor on the northwest, yet she enjoys this distinction which makes her the most interesting point in northern California.

Mt. Lassen is situated at the intersection of Plumas, Lassen, and Tehama Counties, about seventy miles southeast of Mt. Shasta, where her summit rises 10,460 feet above sea level. Until 1914 she was simply a mountain peak of the Sierras, admired from the distance for her beauty, and her sides scaled many times by tourists where from her summit on a clear day may be viewed a panorama of unsurpassed grandeur. Twenty shimmering lakes nestle in the surrounding mountains, while away off to the southwest stretches the Sacramento Valley, Marysville Buttes, and purple Coast Range, and to the northwest Mt. Shasta smiles approval from her superior height.

Mt. Lassen may be reached through Big Meadows, the summer tourists' Mecca, Warner Valley, and Drakeshood. At the last named valley the traveler mounts his horse and goes by trail through a green meadow dotted with myriad wild flowers and bordered by tall pines, fir, and hemlock. After an easy ascent of about nine miles the horses are tethered and the remainder of the distance, about 1,000 feet, is scaled by a steep and difficult path, over boulders, loose rocks, and snow to the summit. The trees which have gradually grown smaller as we ascend, have now given place to some sprawling white-bark pine, not more than ten feet in height. These finally disappear and from this point on not a living plant is seen.

In 1914, on the afternoon of May 20, occurred the first eruption, which was followed throughout the summer by frequent eruptions, all from a fissure near the top. This fissure was about 1,000 feet long, by 700 feet wide, and probably 300 feet deep. Looking into this fissure between periods of eruption, the courageous investigator saw what seemed to be a boiling, steaming, mush pot which would occasionally send up a miniature eruption of steam and lava, and then subside to a quiet bubbling. When in violent eruption and viewed from Big Meadows, there would appear a slight puff of vapor resembling a smoke from a small fire, gradually growing larger and higher when suddenly as if with a great heave there would leap into the air a pillar of vapor, smoke and ash to a height of 1,000 or 1,200 feet. This on a calm day floats off into the heavens at this height, sometimes assuming grotesque or wonderful forms, and after a few hours disappears. On a windy day the smoke and cinders are carried to the northward close to the mountain side where the cinders are deposited for miles around, but in no place to a greater depth than 1½ feet.

On May 22, 1915, there suddenly came a gigantic eruption which seemed to tear the mountain asunder in its intensity and madness. Great volumes of vapor and smoke and ash were hurled into the air to a height of approximately 30,000 feet. Above the mountain a white cloud of vapor had been hovering. Soon a small black cloud of what seemed to be smoke appeared on the summit, and rose slowly until it reached the cloud where it seemed to hesitate for a few minutes, then shot suddenly upward as if hurled from a cannon, This great mass of greyish brown smoke surged up and down continuously while huge forms, darker than the rest were bulging out in different directions assuming strange shapes. This mass loomed above the peak for awhile, then suddenly broke and spread out over the heavens where for several hours, the sky was overhung with this great dark cloud. When it had cleared away the mountain had changed her white robe for one of black, and stood like a huge charred pyramid where but a few hours before she gleamed white in the sunlight. At the time of this eruption the old crater was filled and a new fissure opened up on the northwest slope some distance lower down the mountain side. Near this are several smaller fissures which are constantly emitting vapor.

Standing near the crater is a forest lookout station through which rocks, weighing about 200 pounds, have been hurled. After the first eruption visitors found two of these rocks on the floor, one having entered by way of the roof, breaking the bed, and another had been hurled through the side. The "look-out man" had deserted the cabin leaving bedding, furniture and cooking utensils, all of which had been carried to the summit on his back. Many large rocks had been hurled into the snow and could be seen in the bottom of holes which evidently had been melted when the hot rocks fell.

There are many stories of reputed eruptions, within the past year, one of these within the early part of this year, but these reports are not verified by people living in the vicinity of the volcano. It is stated by reliable persons living within twenty miles of the mountain that there has been no eruption since the summer of 1917.

The California Bush-Tit

MARGARET SHERMAN

If you are looking for, and are the least bit interested in the wit, industriousness, sociability and usefulness of a small creature, you will surely find your ideal in the little gray Bush-Tit.

He is the smallest of all our birds, save the humming bird, and is familiar and abundant on all the Western Coast. The gray midgets may be seen anywhere in the woods, during the winter, busy all day long in their quest for food. Their little twittering song may be heard high and low, far and near. They keep up their tiny snatches of gossip, whether in pairs or flocks. In winter they are found in groups of a dozen or so, which looks as though they were having a house party, but not so, for these are their own immediate family, as they are very enterprising little neighbors and often nest three times during the spring with five to eight children in each brood. They believe in keeping the family together too, as the ancient Greeks did.

The father and mother begin to think of family affairs by January and February and start to hunt diligently for the home site before the frost has left the ground. These tiny creatures build the largest nest among the birds, compared with the size of the builder. After they have been weather-worn, some of their nests measure 12 to 14 inches in length. They may select as nesting site either the top of a high tree or low bush where the wind may rock the cradle or where it is hidden from view. No matter where the nests are built, they are always hung like a pocket. The nests all look alike. They are of a drab, gray or white, depending upon the location of the nest, and are composed of mosses, oak catkins, bits of dried weed fiber, threads of plants, sycamore leaf wool, and other soft bits .

The bush-tit's beak is very small and pointed and it has to carry small loads, therefore the nest is composed of small pieces, making a felt which is not easily torn or broken. The soft silk of the milkweed and thistle down are hidden away in the winter so the bush-tit will find them in the nooks and corners for its nest; it often makes use of spider's silk for the nest because it is soft and warm. The Baltimore Oriole, actually weaves her nest but the bush-tit's is of a coarse strong felt. But, you may ask, if there is a storm, does not the nest pull apart? Oh! no, indeed, although it may hang stretched and blown out of shape, the family of little ones is just as safe as if they were under a strong ledge or roof.

The nest begins with a round, bulging upper end. It narrows after an inch or two and then widens again into a long pocket. A small doorway, just large enough for the parent birds to go through is made on the south side of the pocket so the cold northeast storms will not find a way in. Sometimes one may find three doors in one nest. Way down deep in the pocket, where they are hidden from sight, the dainty white eggs are laid, on a soft blanketed bed of wool or plant down. The young birds remain in the nest until they are full-feathered. They stay about the home tree for several weeks, sitting on a twig at night, snuggled together in a row, like peas or pussy willows on a stem, with a parent on either side as sentinels. The birds look very much like round balls of gray down with just a glimpse of the tiny bill at one side and the tail on the other. They are always hungry and seem never to be satisfied. They eat all the harmful scales of fruit trees and vines. Wherever the black scale is found the little bush-tit will be also and working as hard to get rid of it just as though it were his duty. Therefore it is very useful and should be protected from harm.

The Flower Land—California

Pauline Kirkhuff

No land is more full of colorful bloom than California. Here the casual tourist finds a joy in the miles of gold and purple and blue where the delight of the serious botanist is equally satisfied; for here and everywhere are blossoms which though perhaps not blushing unseen, are as yet unnamed.

California's wide variety of climate and altitude and soil offer opportunity for a wider range of plant life than almost any other region. From the desert with its yucca shafts holding high their waxen bells, the many forms of cacti, sage and greasewood to the fertile valleys flowing as with molten copper and gold and blue when spring is new. With the rich foothill slopes all purple with brodiaea and aspiring poppies, blue-eyed cream-cups, tidy-tips, godetias and myriads of other blooms to set the heart of the artist and the poet a thrill, and inspire something of despair, for only God can paint such scenes as these. The mountains have their gift to offer in rich toned pentstemons, pyrolas, mints and Washington lilies or the blood red glow of the snow plant. Climbing

higher one reaches the glory of glories in the true Alpine meadows. Up and up through deep-rooted Casseope and Alpine sorrel many golden composites cling to the rock-ribbed mountain cliff where only the mountain phlox and lichens find a footing.

Besides these we have in California the bog dwellers. Famous above all the more familiar flowers are the pitcher plants the *Darlingtonia Californica* a strange hooded monster with snak-like head which lures to its death throat all the insects, foolish enough to enter. One more flower group of lilies must not be forgotten. The exquisitely dainty butterfly lilies or Calochortus, California is proud, indeed of her harebell lilies of the Coast range. We have cream and gold with crimson blotched throat, delicate lavender and above all, the "fairy lantern" of which John Muir writes "*Calochortus albus* with pure white flowers, growing in shady places among the foothill shrubs, is I think, the very loveliest of all the lily family, a spotless soul, plant saint that every one must love, and so be made better. It puts the wildest mountaineer on his good behavior, with this plant the whole world would seem rich though none other existed."

Yet, of all California's flowers the poppy is the most universally admired. It enters so completely into the life of her people that it was made the State flower in 1903. We can easily see why it was chosen for the emblem of the "Golden State." It not only suggests the gold beneath California's fertile soil but the golden wheat and the sun-gold overhead. Joaquin Miller, one of California's most famous poet sons, has written these lines of her poppy blooms—

> The golden poppy is God's gold,
> The gold that lifts, nor weighs us down,
> The gold that knows no miser's hold,
> The gold that banks not in the town,
> But singing, laughing, freely spills
> Its hoard far up the happy hills;
> Far up, far down, at every turn,—
> What beggar has not gold to burn?

From a mass of delicately cut, gray-green foliage the poppy bud stands erect on a long slender stem. A queer little toboggan cap of pale green with rosy tip covers the petals and gives the children the chance to call it the poppies' "night cap." This cap breaks around the base when all is ready for blossom time. Up, up it slips along the golden petal roll until it is pushed off leaving the

petals free to open wide to the warm sun, a real cup of gold. Some cups are deepest orange, others palest lemon yellow, others with golden tips and heart of orange, still others are white or flame red.

In the flower's heart stands the cluster of richly pollen-laden stamens. As the pollen is shed these stamens droop and form a star about the upright pistil which looks so like a candle it has suggested the stanza in Elizabeth Gorden's charmingly descriptive poem on "The California Poppy":

When Day Break sounds his bugle call
The sunny-hearted Poppies all,
Rise from their places one by one
And take their hats off to the sun.
When evening paints the Golden West,
Bringing wee babies sleep and rest,
With tiny candles all alight
Each poppy bids the Sun "Good Night!"

All my readers know the California poppy for it has gone to make its home in many lands—but never can you know its real beauty until you come to see it in its native home, one glowing, throbbing satin-like scarf drawn through the valleys and upland meadows from north to south of the Golden State.

The Redwood

Belle Thompson

Those who have travelled in the country along the coast of Northern California will never forget the redwood. Its great, erect stature fills one with an awe almost holy. The beauty and grandeur of a redwood forest is beyond human description. As we wander along a forest road we see shadowy cathedrals mossy carpeted and banked with sword and five-fingered ferns. An occasional violet, trillum, yellow pansy or oxalis lifts its head to smile at the trees which have stood sentinels for six or eight hundred years, keeping out the sunbeams which manage, only, to peep through the tops of those horizontally branched crowns.

We must not forget the characteristic shaggy bark of the redwood for it gives the tree that wonderful rich-red glow which fairly warms our hearts. The wood of the tree is soft and easily worked and because of the absence of resin is not inflammable to any extent. For this reason there are not many forest fires in redwood regions. The redwood is a very popular building material in California and in the United States and is now being shipped to

other countries. We can see therefore that the redwood has a commercial value as well as an aesthetic value.

Precious Gem Mines in California

LLOYD BROOKS

California must not only be remembered by the rest of the world as a state where sunshine and beautiful flowers are abundant but also as a state of many precious gem mines.

In locating our California mines we cannot confine ourselves to any one portion of the state but we must cover the whole state. It is also impossible in writing so short an article to describe and locate all the mines so I shall deal with but a few of them.

First is the gold region of the central and northern counties along the western base of the Sierra Nevada mountains. Here also are found a few diamonds. Gold is found over the entire state but the principal deposits are in the north.

The second district is that centering round Visalia, just south of Fresno. Here we find some beautiful stones and many forms of quartz minerals used for ornamental purposes. Here we find one stone of particular interest to the Californian, a compact green variety of vesuvianite which resembles closely the jade so much in use in the orient. This is also found in a few of the northern counties but in no other state nor in any other part of the world.

The third district is an arid, desert region in southern California where there are many mines producing turquoise.

The fourth district centers around San Diego and is the principle gem district of the state, having been developed within the past few years; many of the mines are at present mere "prospects" since they have not been developed. The gems found here are tourmaline, spodumeone, topaz, transparent epidote, axinch, pink, green, and blue beryl, and garnet.

Chalcedony occurs as a pebble on the beaches at Redondo, Crescent City and Pescadero. Occuring with these are pebbles of agate and jasper, beautifully marked. These stones are easily polished and make attractive jewelry. Chrysoprase is another rare stone found in California in the district above Visalia and in a few other parts of the world. This stone was but recently discovered here and is a chaleedony that is colored a beautiful light green by oxide of nickel. It is a favorite stone in jewelry and was used extensively for ornamental work in the ancient times.

THE NATURE-STUDY REVIEW

DEVOTED PRIMARILY TO ALL SCIENTIFIC STUDIES OF NATURE IN ELEMENTARY SCHOOLS

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Editorial

Our Contributors

It is with great pride that we note the names of the contributors to this number of The Review. Dr. David Starr Jordan, the intellectual founder and long time President of Stanford University, a man as great in science as in education and social betterment, than whom no one has written more charming nature stories, has given us an account of his garden and its tenants. Douglas Houghton Campbell is perhaps more than any other American a world-botanist for there are few corners of this old earth in which he has not personally studied and collected the flora and his contributions to science make volumes of great importance. His garden on a hillside above Stanford University is one of the beauty spots of that delectable institution. John Casper Branner who followed Dr. Jordan as President of Stanford University is a geologist of the two Americas. His writings on the Geology of Brazil as well as of the United States have placed him among the foremost geologists of the world and yet he unbends for The Review with this charming Armadillo story. Albert W. Smith, for many years at the head of the Mechanical Engineering College of Stanford, later Dean of Sibley College at Cornell, and at present Acting President of Cornell University, whose gift for poetry has added greatly to the happiness and cheer of his friends, has given us two very characteristic poems, one full of appreciation of beauty and the other of delightful humor. Julia Ellen Rogers, whose Tree Book and Shell Book and other nature volumes are in use in every nature library in our country gives us a glimpse of springtime in the California desert. Irenè Hardy whose eyes saw so comprehendingly and whose spirit comprehended so perfectly what she saw still writes as exquisitely as ever of the birds and the flowers although for many years she has been blind. She is a living

example of the worth of treasuring spiritual riches. Her broad culture, broad sympathies and artistic sense have placed her among the first of California poets.

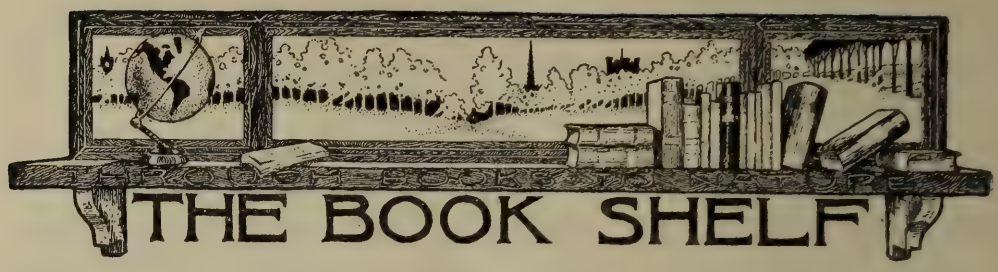
Bertha Chapman Cady, the author of the most excellent book on sex education and a well-known teacher of nature-study and gardening, gives us an account in the Nature Camp on Mt. Shasta and also sends a symposium of California nature stories from her class of the Chico Normal School. Mr. C. M. Goethe, a very busy business man of Sacramento, has found time to do a large part in establishing the Nature League in California, a very important and active organization, and he tells us of its inception and growth. Mr. Carroll DeWilson Scott has given us poems full of California beauty and feeling. Professor Clayton F. Palmer, whose work in the Los Angeles School is well-known tells of the work done there for elementary agriculture. Miss Snow Longley gives us a delightful account of a weasel's personality.

No other issue of THE NATURE-STUDY REVIEW has ever had so many eminent scientists and writers as contributors, and the editor and the readers of THE REVIEW are proportionately grateful.

CALIFORNIA

Even the name California has a charm of its own, and to one who knows the state it recalls a picture with a background of steep rugged mountains, shimmering with varying tints of ravishing purples and azures, flanked by vivid green, poppy-decked foothills, a foreground of level stretches broidered with a cliquish flora, each species in a mass by itself, the masses commingling like a Persian tapestry. Or it calls up visions of vast orchards abloom, or orange trees gold-laden or of giant forest trees so straight and tall that they look slender although each trunk may measure many feet across; or of dashing mountain streams, fed from the melting snows or mountain meadows, set with purple lupines.

And yet it often happens that the eastern traveller is disappointed in California, and why? Because he expects to carry along his own eastern landscape of intimate hills, woodlands and streams green fields and prattling brooks and find added unto it the glories of the Pacific Coast. How impossible! It is only after the newcomer realizes that California is too great and wonderful to be an adjunct to anything else in the world, that his ideas change and his appreciation grows until it is equal to the revelations of beauty found in the widely varied scenery of this great State.



The Community Center. L. J. Hanifan, State Supervisor of Rural Schools, West Virginia. (Teacher Training Series). Published by Silver, Burdett & Company. 214 pages.

This book is a comprehensive manual on the subject of community center development, especially adapted to the needs of teachers in rural communities where conditions naturally indicate the teacher as the person, generally the only person, fitted to take the initiative in community activities. The author says in the preface: "—— the book undertakes to present some of the more important rural life problems, particularly as regards rural social life and recreation, and to offer suggestions as to how the teacher, by means of the school as a community center, may contribute very largely to the solution of these problems." A predecessor of this volume, "A Handbook for Community Meetings in Rural Schoolhouses," by the same author, met with the approval of Commissioner Claxton and was made available for distribution to county superintendents throughout the United States.

The book fulfills admirably the modest promise set forth in its preface. It is a welcome addition to the limited number of publications on community activities and is unique in the field it covers. A selection from the table of contents will give an idea of the scope of the work. "The Community Center and the World War," (the tremendous impulse given by the war to the community center idea); "Leadership and the Community Center;" "Social Capital—its Deveopment and Use;" "The Community Center as an Aid to Teaching;" "First Steps in the Community Center;" "Special School Programs;" "Miscellaneous Activities within the Community Center." No phase of the subject is left untouched. An excellent bibliography completes the book

B. W. L.

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Bracken, a Fern whose home is the world

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The Common Polypody Fern

TABLE OF CONTENTS

Fern Study - - - - - - 235

How to Know the Ferns - - - - 244

List of Common Ferns - - - - - 255

The Katydid—Florence White - - - - 258

Outline for Study of Fossils—Carroll Lane Fenton - - 262

Asters—W. P. Alexander - - - - 266

Oregon News—J. W. Thompson - - - - 271

Editorial - - - - - - 273

Bookshelf - - - - - - 275

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Fern Study

Of all plants, the ferns have the most beautiful leaves; this seems the more wonderful when we realize that the ferns are among the most ancient of plants; they are the most abundant plants of the coal period both as to individuals and species. As a child, I held the firm belief that the Creator so loved the exquisite forms wrought by frost crystals on the window panes that He repeated the patterns in the fern leaves as a sign that beauty was an integral part in the plan of the universe.

Few of us stop to think that the coal which warms us today was made of the leaves, stems and spores of the ferns. Dr. David Starr Jordan in his "A Story of a Stone" describes the ferns of the coal measures thus: "The great ferns and rushes, big as an oak and tall as a steeple, grew in the swamps. Their green plumes were so long and so densely interwoven that the Man of the Moon might have fancied the earth was feathering out. Then all about, huge reptiles, with jaws like the gates of doom and teeth like cross-cut saws, and little reptiles with wings like bats, crawled, and swam, and flew. But the ferns died, and the reptiles died, and the rush-trees fell in the swamps, and the Illinois and the Sangamon and the Wabash and all the other rivers covered them up. They stewed away under layers of clay and sand, till at last they turned into coal and wept bitter tears of petroleum."

In these later days the tree-ferns grow only in the tropics but fortunately for us there are many species of lowly habits left to gladden our eyes. As subjects for nature study the ferns are most attractive. Any locality is rich that has twenty species and therefore it is a great stimulant to interest the pupils to make a collection of all the kinds of ferns in their environment.

Since ferns are easily pressed and are beautiful objects when mounted on white paper, the making of a fern herbarium is a delightful pastime; or leaf-prints may be made which give beautiful results; but, better perhaps, than either collections or prints,

are pencil or water-color drawings with details of the fruiting organs enlarged. Such a portfolio is not only a thing of beauty but the close observation needed for drawing brings much knowledge to the artist.

The Parts of a Fern

In order to talk about ferns intelligently we are obliged to speak in fern language. Each part of the fern has its own name which should be learned quite incidentally while studying the plant. The accompanying diagram explains the terms and should be used for reference. The teacher should use these terms constantly and insistently, so as to make the fern nomenclature a part of the school vocabulary, and thus fit the pupils for using fern manuals.

Leaf-print of a fern with the parts named. This fern is twice pinnate.

The *frond* is all of the fern which grows on one stem from the rootstock.

A *sterile frond* bears no fruit.

A *fertile frond* bears the fern fruit which consists of spores.

The *blade* is that portion which bears leaflets.

The *stipe* is the stem or petiole.

The *rachis* is the midrib and is a continuation of the stipe.

The *pinnule* is a leaflet of the last division.

The *pinna* is a chief division of the midrib or rachis, when the fern is compound.

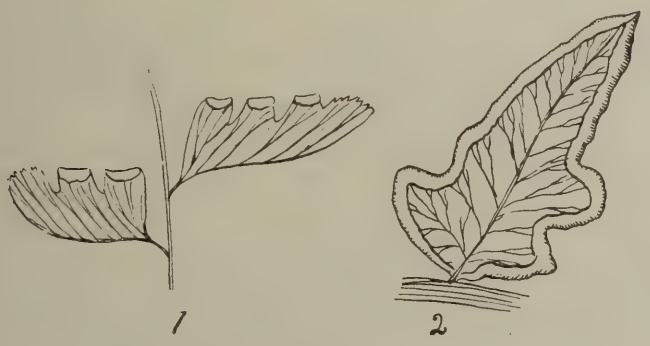
The *sori* are the fruit dots.

The *indusium* is the membrane covering the fruiting organs.

The *sporangia* are tiny brown globules, and are the spore cases in which the spores are developed.

The *spores* make up the fine dust which comes from the spore-cases. A spore in not a seed. A seed is developed by pollen and an ovule. The spore is simply a specialized part of the fern leaf.

It would be well to make a diagram on the blackboard of the fern with its parts named, so that the pupils may consult it while studying ferns.

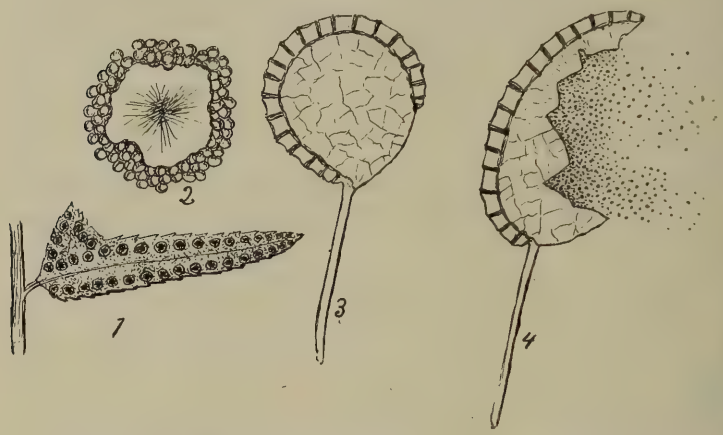


1. Fruiting pinnules of the maiden-hair fern, enlarged. 2. Fruiting pinnule of the bracken, enlarged. In both these species the spores are borne under the recurved edges of the pinnules.

How a Fern Fruits

The Christmas fern may be taken as a type in describing the fruiting organs. In studying a fertile frond of the Christmas fern from above, we notice that about a dozen pairs of the pinnae near the tip are narrowed and roughened and are more distinctly

toothed on the margins. Examining them underneath, we find on each a double row of circular raised dots which are the fruit-dots, or sori; there is a row between the midrib and margin on each side, and also a double row extending up into the point at the base. Early in the season these spots look like pale blisters, later they turn pale brown, each blister having a depression at its center; by the middle of June, masses of tiny globules, not larger than pin points, push out from beneath the margins of these dots. The blisterlike membrane is simply a cover for the growing spores, and is called the *indusium;* by July it shrivels into an irregular scroll, still clinging to the pinnule by its depressed center; and by this time the masses of tiny globules cover the entire under side of the pinna like a brown fuzz. If we scrape off some of this fuzz and examine it with a lens, we can see that it consists of numberless little globules, each with a stem to attach it to the leaf; these are the spore cases, or sporangia, each globule being packed full of spores which, even through the lens, look like yellowish powder. But each particle of this dust has its own structure and contains in its heart the living fern-substance.

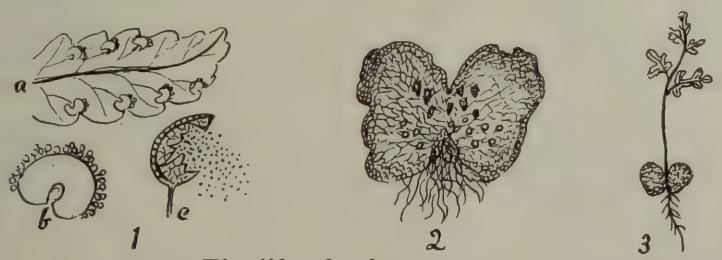


1. Fertile leaflet of Christmas fern showing indusia and spore-cases. 2. An indusium and spore-cases, enlarged. 3. A spore-case, enlarged. 4. A spore-case discharging spores, enlarged.

Not all the fronds of the fern clump bear these fruit-dots. The ones we select for decoration are usually the sterile fronds, for the fertile ones are not so graceful, and many ignorant people think the brown spore-cases are a fungus.

How a Fern Grows

Shake the dust out of the ripened fern and each particle, although too small for the naked eye to see, has within it the possibilities of developing a mass of graceful ferns. Each spore has an outside hard layer, and within this an atom of fern-substance; but it cannot be developed unless it falls into some warm, damp place favorable for its growth; it may have to wait many years before chance gives it this favorable condition, but it is strong and patient and retains its vital power for a long period. There are cases known where spores grew after twenty years of waiting. But what does this microscopic atom grow into? It develops into a tiny-heart-shaped, leaflike structure which botanists call the *prothallium;* this has on its lower side little roots which reach down into the soil for nourishment; and on its upper surface are two kinds of pockets, one round and the other long. In the round pockets are developed bodies which may be compared to pollen; and in the long pockets, bodies which may be compared to the ovules of flowering plants. In the case of ferns, water is necessary to float the pollen from the round pockets to the ovules in the long pockets. From a germ thus fertilized in one of the long pockets,



The life of a fern.

1. *a*, pinna bearing fruit; *b*, a fruit-dot, enlarged, showing spore-cases pushing out around the edges of the indusium; *c*, spore-case, enlarged, showing how it discharges the spores.
2. Prothallium, enlarged.
3. Young fern growing from the prothallium.

a little green fern starts to grow, although it may be several years before it becomes a plant strong enough to send up fronds with spore-dots on them. To study the structure of the spore requires the highest powers of the microscope; and even the prothallium in most species is very small, varying from the size of a pin-head to that of a small pea, and it is therefore quite difficult to find. I found some once on a mossy log that bridged a stream, and I was never so triumphant over any other outdoor achievement. They may be found in damp places in greenhouses, but the

teacher will be very fortunate who is able to show her pupils this stage of the fern. The prothallium is a stage of the fern to be compared to the flower of the higher plants; but this is difficult for young minds to comprehend. I like to tell the children that

The Christmas fern. The contracted tips of some of the fronds are fruiting pinnae.

the fern, like a butterfly, has several stages: Beginning with the spore-bearing fern, we next have the spores, next the prothallium stage, and then the young fern. While in the other case we have first the egg, then the caterpillar, then the chrysalis, and then the butterfly.

Looking at the ripe fruit-dots on the lower side of the fern leaf, we can easily see with a lens a mass of tiny globules; each one of these is a spore-case, or *sporangium* (plural *sporangia*), and is fastened to the leaf by a stalk and has, almost encircling it, a jointed ring. When the spores are ripe, this ring straightens out and ruptures the globules. and out fly the spores. By scraping a little of the brown fuzz from a fruiting pinna of the Christmas fern upon a glass slide and placing a cover glass upon it, we find it very easy to examine through the microscope, and we are able thus to find the spore-cases in all stages, and to see the spores distinctly. The spore-cases may also be seen with a hand lens, the spores seeming then to be mere dust.

The rootstock of the fern is an humble example of "rising on stepping stones of our dead selves," this being almost literally true of the tree-ferns. The rootstock which is a stem and not a root—has, like other stems, a growing tip from which, each year, it sends up into the world several beautiful green fronds, and numerous rootlets down into the earth. These graceful fronds rejoice the world and our eyes for the summer, and make glad the one who, in winter, loves to wander often in the woods to inquire after the welfare of his many friends during their period of sleeping and waking. These fronds, after giving their message of winter cheer, and after the following summer has made the whole woodland green and the young fronds are growing thriftily from the tip of the rootstock, die down, and in midsummer we can find the old fronds lying sere and brown, with broken stipes, just back of the new fern clump; if we examine the rootstock we can detect behind them, remains of the stems of the fronds of year before last; and still farther behind we may trace all the stems of fronds which gladdened the world three years ago. Thus we learn that this rootstock may have been creeping on an inch or so each season for many years, always busy with the present and giving no heed to its dead past. One of the chief differences between our ferns and the tree-ferns of the tropics, which we often see in greenhouses, is that in the tree-fern the rootstock rises in the air instead of creeping on, or below, the surface of the ground. This upright rootstock of the tree-fern also bears fronds at its tip, and its old fronds gradually die down, leaving a rough "trunk" below its crown of green plumes.

The Fern Bud or Crosier

Of all "plant babies," that of the fern is most cozily cuddled; one feels when looking at it, that not only are its eyes shut but its fists are tightly closed. But the first glance at one of these little woolly spirals gives us but small conception of its marvelous

Fiddle heads, or crosiers. Young ferns unfolding.

enfolding, all so systematic and perfect that it seems another evidence of the divine origin of mathematics. Every part of the frond is present in that bud, even to the fruiting organs; all the pinnae and the pinnules are packed in the smallest compass—each division, even to the smallest pinnule, coiled in a spiral towards its base. These coiled fern buds are called crosiers; they are

woolly, with scales instead of hairs, and are thus well blanketed. Some botanists object to the comparison of the woolly or fuzzy clothing of young plants with the blankets of human infants. It is true that the young plant is not kept at a higher temperature by this covering; but because of it, transpiration which is a cooling process is prevented, and thus the plant is kept warmer. When the fern commences to grow, it stretches up and seems to lean over backward in its effort to be bigger. First the main stem, or rachis, loosens its coil; but before this is completed, the pinnae, which are coiled at right angles to the main stem, begin to unfold; a little later the pinnules, which are folded at right angles to the pinnae, loosen and seem to stretch and yawn before taking a look at the world which they have just entered; it may be several days before all signs of the complex coiling disappear. The crosiers of the bracken are queer looking creatures, soon developing three claws which some people say look like the talons of an eagle; and so intricate is the action of their multitudinous spirals, that to watch them unfolding impresses one as being in the presence of a miracle.

Fern Song

Dance to the beat of the rain, little Fern
And spread out your palms again,
And say, "Tho' the sun
Hath my vesture spun,
He had labored, alas, in vain,
But for the shade
That the cloud hath made,
And the gift of the Dew and the Rain."
Then laugh and upturn
All your fronds, little Fern,
And rejoice in the beat of the rain!

—John B. Tabb.

Christmas fern is below the others.

How to Know the Ferns

The ferns are classified by their methods of bearing their spores. In some cases the spores are borne on fronds that do not resemble the sterile fronds of the species in appearance. In others they are borne on the lower sides of fronds that are quite similar to those that bear no spores. In the latter cases, the shape of the fruit-dots and the way they are blanketed, i.e. the shape of the indusium, may afford the basis of classification. The following is an attempt to define and illustrate the fern genera so that the beginner may be guided into a more serious study of these beautiful plants with the help of the excellent manuals which have been written by experts in fern knowledge.

The Grape Ferns. *Botrychium*

There are six species of these which grow in moist woods or swamps and they vary in size from the little Moonwort which may be only two inches high to the Rattlesnake Fern which often reaches the height of two feet. In the Grape Ferns the sterile and fertile fronds are separate above but unite into one stem except in the Common Grape Fern where the two have separate stems. The fertile fronds have their pinnae reduced to little flattened

globes which through a lens look like bunches of grapes. The fertile frond may be single, simple, and leaf-like as in the little Grape Fern or lobed as in the Moonwort or triangular and compound as in the other species.

The Rattlesnake Fern
4"- 2'

The Rattlesnake Fern is rarely recognized as a fern, its large, triangular, much-divided frond is light-green, lace-like and delicate; it loves rich shady woodlands where there is plenty of moisture. The Common Grape Fern which also has a much-divided triangular sterile frond is not more than a foot high; its fertile frond is on a separate stalk and is so full of fruit that it looks like a tiny grape cluster. This species is found in moist meadows, pastures, and open woods.

The Osmundas

There are three species of Osmunda; they are all large, handsome, rather coarse ferns and grow preferably in low ground and swampy places.

The Interrupted Fern (Fig. 1) has sterile fronds from two to four feet high. Some of the largest fronds have some pairs of the middle pinnae changed in form and bearing fruit. Its sterile fronds resemble very much the next species.

The Interrupted. Cinnamon and Royal Fern
2'- 4' 3'- 6' 2'- 6'

The Cinnamon Fern grows vigorously and may be distinguished from the Interrupted Fern by the tuft of rusty wool which clings to the base of each pinna. The Cinnamon Fern may have fronds five or six feet high in favorable places. The sterile fronds (Fig. 3) grow in a circle and the fruiting fronds (Fig. 2) appear at the center of the clump and do not look like ferns at all. They are rusty in color because of the cinnamon-colored spore cases and are club-shaped.

The Royal or Flowering Fern is twice pinnate. The lower pinnae looks like branches. The three or four upper pairs of pinnae are changed in form and bear the fruit (Fig. 4).

The spore cases in all the Osmundas consist of reduced pinnae changed in form to flattened spheres and open in halves. (Fig. 5).

The Adder's Tongue. *Ophioglossum*

Curly Grass, Adder's Tongue
3"- 5" 2"- 12"

This is a queer member of the fern family. Its little sterile frond is separate from the fruiting frond but both use the same stem. It may be two inches or a foot in height and it grows in moist meadows and thickets. It is related to the Grape Ferns.

The Curly Grass. *Schizæaceæ*

This does not look in the least like a fern; its sterile fronds indeed do look like curly grass; its fertile fronds have long stems and are triangular in shape and may be from three to five inches high. Curly grass grows in wet soil, in pine barrens from New Jersey to Nova Scotia.

The Climbing Fern. *Lygodium*

Certainly the uninitiated would never suspect that this delcate vine was a member of the fern family. It grows in moist thickets and open woods; its slender twining stems may be from twelve to forty inches long. The pinnules look like broad lobed leaves-and occur in pairs. The pinnules at the tip although still leaf shaped are very small and bear the spores on their under sides protected by overlapping scale-like indusia. This beautiful fern has been so ruthlessly gathered that it has become extinct in many places. Connecticut has a law protecting it.

The Climbing Fern
1'- 3'

The Onocleas. *Onoclea*

There are two species of these ferns which differ very much in appearance:

The Sensitive Fern is especially fond of gracing our roadsides and wet meadows with its pale green triangular fronds and often

occur in large patches. The fertile fronds look very different being much contracted with the pinnules rolled up into spore cases which are green at first and later brown. There sometimes occur intermediate forms with narrower fronds which are sterile. This is called the Sensitive Fern because it is killed by the first frost.

The Sensitive Fern
1'- 3'

The Ostrich Fern grows in moist woods or other shady, damp places and often grows luxuriantly on the north side of houses where it joins the army of ornamental plants. It is a magnificent fern with dark-green fronds from two to ten feet in height which have some resemblance to ostrich plumes. The sterile fronds grow in a circle and the fertile fronds which are shorter grow at the center. The fertile fronds have pinnae which are very stiff with the lobes rolled inward to cover the spores which gives the fruiting pinnae a beaded effect.

The Ostrich Fern
3'- 7'

The Woodsias. *Woodsia*

These are rock-loving ferns, all of them small and growing in tufts or clumps. They may be known by their manner of fruiting—the indusium is fastened to the frond beneath the fruit dot and splits open above spreading out in star shape around the spore cases (Fig. 1b). There are six species of Woodsias but the only common one is that figured here.

The Obtuse Woodsia. This species has fronds that may grow to fifteen or twenty inches in length but are commonly shorter. This is found in but one place (in Nova Scotia) outside of the United States. It grows on rocky banks and cliffs from New England to Georgia and westward. In the South it is evergreen.

The Obtuse Woodsia
8"- 20"

The Boulder or Hay-Scented Fern. *Dicksonia*

This delicate fern makes beautiful rocky pastures and hillsides, especially in New England. Its delicate pale green fronds are of elaborate pattern and measure from one to three feet in height. It grows in shade often but likes sunny locations and often occurs in large patches. Its spore cases are borne on a recurved pinnule in a very delicate cup and are very small.

The Boulder Fern
1/3

The Bladder Ferns. *Cystopteris*

"Delicate rock ferns" would be a better name for these fragile, exquisite plants which drape themselves like green lace over the damp shady rocks in ravines and along lakeside cliffs. The spore cases when young are protected by an indusium shaped like a little cup but this tiny cuplet is only seen early in the season for it withers soon leaving the fruit dots naked. Almost every frond bears fruit.

Photo by Verne Morton

The bulb-bearing bladder fern. This beautiful fern clothes the banks of damp ravines. It has, in addition to fruiting organs, buds on the stem which take root.

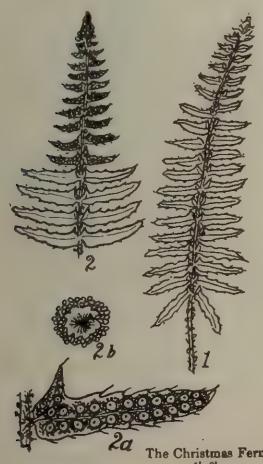
The Bulb-bearing Bladder Fern is long and slender, its frond often reaching the length of one to three feet; it usually hangs down over the rock in a most decorative manner. Along its rachis are little globular bulbs about the size of a pepper grain which, when they come in contact with the soil, put forth roots and start a new fern.

The Bulb-bearing and the Fragile Bladder Ferns
1'-25" 8"-15"

The Fragile Bladder Fern. This species is even more delicate than the preceding; it rarely reaches the length of fifteeninches. It is the first fern of all to put forth fronds in the spring and is often found growing in company with its bulb-bearing sister. This fern is sometimes confused with the Obtuse Woodsia which grows in the same situations, but the latter shows remnants of an indusium extending out star-shaped beyond its fruit dots.

The Christmas Fern. *Polystichum*

This thick handsome fern has great attractions for the lover of woods especially in fall or winter when its fronds give a Christmas-like cheer to the brown or snowy forest floor. It is very lasting after being gathered and therefore is used much in decoration. The sterile fronds are broader and shorter than those which bear the spores; the fertile fronds have smaller pinnae toward the tip which are crowded below with fruit dots until they look as if they were covered with fungus, which is an opinion commonly held by the uninformed. The spore blanket or indusium is fastened at the center and opens all around its margin. The Christmas Fern is abundant on hillsides, in woods, and in rocky situations. Its stems (stipes) are covered with dense chaff and are often from five to seven inches long while the whole frond often attains the length of two feet. There are two species of Holly Ferns which are near relatives of the Christmas Fern but are more spiny.



The Christmas Fern
1'-3'

The Wood Ferns. *Dryopteris. Aspidium*

These are our favorite ferns of the shady woods and there are numerous species. The fruiting and the sterile fronds are alike, the spores being borne on the lower side. The species may all be known as belonging to this genus by the shape of the spore blanket, the indusium, which is kidney-shaped and attached to the frond by its concave edge (Fig. 3). Perhaps the two most generally known of the Wood Ferns are the Marginal Shield and the Spinulose. The other species are the New York, the Marsh, the Massachusetts, the Fragrant, the Crested, the Goldies, the Boott's, Shield Ferns, and the Male Fern.

The Marginal and the Spiny Wood Ferns
1/3 1/3

The Marginal Shield Fern or, as it is often called, the Evergreen Wood Fern is very common from Canada to Arkansas in rocky woods and on wooded banks. It is a large, rather coarse fern, vividly dark green, its pinnae deeply lobed, its fronds from eighteen inches to three feet in height. It may be identified by its fruit dots which ornament the edges of the lobes of the pinnae on the lower side. Just before the spores are shed the spore cases are black and crowd out around the edges of the kidney-shaped indusium.

The Spinulose or Spiny Wood Fern. This is exquisitely beautiful; its pinnae are deeply lobed and the lobes are toothed and each tooth ends in a little spine which gives a lacey appearance to the frond. Added to its beauty is its keeping quality for it is also evergreen and remains fresh a long time after it is put in a vase. The Boulder Fern resembles this species in form but it wilts as soon as gathered and grows in entirely different situations. The Spiny Wood Fern bears its fruit dots on the under side of the lobe of its fronds, one below a tooth.

The Triangle Ferns. *Phegopteris*

There are three species of the Triangular Ferns and like the Polypody they do not blanket their fruit dots but bear the spore cases naked. Figure 1 shows the broad Beech Fern, 1a the fruiting pinnule. This fern is supposed to like to grow beneath beech

trees but as a matter of fact it grows in both deep and shady woodlands and also in rather open dry woods and on hillsides. The fronds may attain a height of from ten to eighteen inches and almost all of them bear numerous small fruit dots on the lower side.

The Long Beech Fern is not so broad as the above in proportion and is found on wet rocks along woodland brooks. It is often eighteen inches high.

The Oak Fern looks like a pigmy bracken for its lower pinnae are nearly three times divided. It sometimes attains the height of eighteen inches but it is usually less than a foot in height and its color is a delicate yellow-green. It grows in rich, moist, rocky woods.

The Broad Beech Fern
15"-30"

The Chain Ferns. *Woodwardia*

These are large, rather coarse ferns that grow in swamps and wet woods. They are called Chain Ferns because of the chain-like appearance of their oblong rectangular fruit dots. There are two species, the Narrow-leaved Chain Fern is sometimes mistaken for the Sensitive Fern which it resembles and its fruiting fronds have narrow pinnae, but the peculiar chain-like fruit dots on the lower side at once distinguish the species.

The Virginian Chain Fern has fronds from two to four feet high and is as big and handsome as the Osmundas with whom it is often associated. Its sterile and fertile fronds are similar.

The Virginian Chain Fern 2'-4' Harts Tongue 10"-20"

The Hart's Tongue. *Scolopendrium*

This can not be called a beautiful fern and its chief attraction is that it is very rare and only found here and there on corniferous limestone in North America and Asia. Its fertile and sterile fronds are similar and are long and leaf-like and may reach from seven to eighteen inches in length.

The Walking Fern. *Camptosorus*

This quaint little fern likes rocky places. Its fronds measure from four inches to a foot in length; they arise from a common center and spread in every direction; if the long extended tip of a frond finds itself in favorable soil it sends down roots and sends up a little frond and a new plant is started. This habit gives the fern its name. Its fruit dots are elongated and scattered over the lower surface of the frond at all angles. The Walking Fern has suffered also from conscienceless collectors.

Walking Fern
6"- 8"

The Spleenworts. *Asplenium*

The spleenworts have their varying forms but, however they may differ in appearance, they all have the same kind of fruiting organs. The indusium is oblong more or less crescent-shaped and generally is placed oblique to the midrib and opens toward the midrib of the pinna. There are three large species, the Lady Fern, the Narrow-leaved, and the Silvery spleenworts which have fronds from two to four feet high. They grow in moist woods and shady ravines and the fruiting and the sterile fronds differ very little.

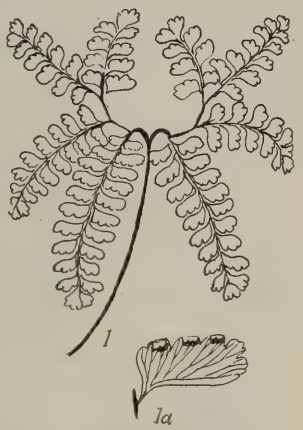
The rock spleenworts do not resemble the above in any way except in the manner of fruiting. There are nine species of these small ferns, the green, the mountain, the rock, the small, the pinnatified, the maidenhair, the ebony, the Bradley's, the Scott's, and the wall rue.

The Ebony, The Narrow-leaved Spleenwort
5" 20" 2'- 4'
The Lady Fern and Wall Rue
1'- 4' 5"

The Maidenhair Fern. *Adiantum*

This delicate fern bears a striking resemblance to meadow rue but need never to be confused with it because of its dark-brown shining stem, if for no other characteristic. It grows in clumps in

moist woods. The Maidenhair has a cosy way of blanketing her spores by folding over the tips of the lobes of her pinnules to protect them.



The Maidenhair
8"-20"

The Bracken. *Pteris*

This great triangular fern is a cosmopolite. It grows in waste places, fence corners, borders of woods, in almost any dry or moist place in North America. It clothes certain mountains in the California coast range. It likewise clothes Scottish mountains and the Alps and the mountains of Sicily. Many superstitions and legends cluster around it. The Bracken is valuable as a lesson on the intricate patterns of the fern leaf, a lesson in pinnateness. The two lower branchlike pinnae are large and spreading and are in themselves three times pinnate; the pinnae higher up are twice pinnate; while the main frond near the tip is once pinnate and at the tip is merely lobed. It grows to a height of from one to three feet usually but in favorable locations may attain six feet. It covers its spore cases by folding the margins of its pinnules over them; the fruiting pinnules look as if they were hemmed and the edges of the hem embroidered with brown wool; but if the latter is examined through a lens it is found to be made up of spore cases.

The Bracken
1'-6'

The Cliff Brakes. *Pellaea*

There are only two species of these commonly found. Both bear their spore cases on the under side of the fronds, beneath the folded over margin of the pinnules, much as in the Bracken.

The Slender Cliff Brake. This delicate little fern, not more than from three to six inches high, grows in shady and moist places, especially on limestone rocks. The fertile frond differs from the sterile frond in form.

The Slender and the Purple Cliff Brakes
3"-6" 4"-24"

The Purple Cliff Brake or Winter Brake. This is a larger species than the above having fronds from four to twenty inches long; these fronds are characterized by a peculiar bluish-green color while the stipes are dark purplish-brown. This species grows on rocks in limestone regions.

The Lip Ferns. *Cheilanthes*

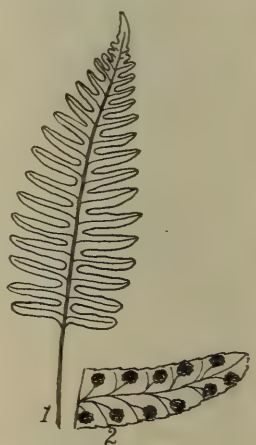
These are woolly little ferns that blanket their spores with the folded over margins of their pinnules just as does the bracken. There are four species in the United States all growing on rocks. Three of them, the Woolly Lip Fern, the Alabama Lip Fern and the Slender or Fee's Lip Fern are found in the Mississippi Valley especially in the South.

The Hairy-lip Fern

Figure 1 shows the Hairy Lip Fern. Figure 2 shows a fruiting pinnule on the under side with its edges folded over the spore cases. This is the only common Lip Fern in the North. It grows on cliffs from Connecticut to Minnesota and southward; its fronds are from six to fifteen inches long and both stem and pinnules are covered with short bristly hairs.

The Common Polypody. *Polypodium*

This cheery little fern loves to grow on shady ledges or upon tree trunks but it does not like damp situations. Its frond is thick and evergreen and the brown fruit dots on the lower side are never blanketed at all. The polypody raises her spore children without any indusium to protect them. There is only one species common in the North. In the South the gray polypody decorates tree trunks most attractively.



The Common Polypody

A LIST OF THE COMMON FERNS

Botrychium

Little Grape Fern, *Botrychium simplex.*
Moonwort, *Botrychium Lunaria.*
Matricary Grape-Fern, *Botrychium matricariaefolium.*
Ternate Grape-Fern, *Botrychium ternatum.*
Lance-leaved Grape-fern, *Botrychium lanceolatum.*
Virginia Grape-Fern, *Botrychium Virginiaum.*

Osmunda

Interrrupted Fern, *Osmunda Claytoniana.*
Cinnamon Fern, *Osmunda cinnamomea.*
Royal or Flowering Fern, *Osmunda regalis.*

Trichomanes

Bristle-Fern, *Trichomanes radicans* (found from Kentucky southward).

Ophioglossaceae

Adder's Tongue, *Ophioglossum vulgatum.*

Schizaeaceae

Curly Grass, *Schizaea pusilla.*

Lygodium

Climbing Fern, *Lygodium palmatum.*

Onoclea

Sensitive Fern, *Onoclea sensibilis.*
Ostrich Fern, *Onoclea Struthiopteris.*

Woodsia

Rusty Woodsia, *Woodsia Ilvensis.*
Alpine Woodsia, *Woodsia alpina.*
Smooth Woodsia, *Woodsia glabella.*
Rocky Mountain Woodsia, *Woodsia scopulina.*
Oregon Woodsia, *Woodsia Oregona.*
Blunt-lobed Woodsia, *Woodsia obtusa.*

Dicksonia

Hay-scented or Boulder Fern, *Dicksonia punctilobula.*

Cystopteris

Bulb-bearing Cystopteris, *Cystopteris bulbifera.*
Fragile Cystopteris or Brittle Fern, *Cystopteris fragilis.*
Mountain Cystopteris, *Cystopteris montana.*

Polystichum

(Called by some botanists Aspidium or Dryopteris)

Christmas Fern, *Polystichum acrostichoides.*
Holly Fern, *Polystichum Lonchitis.*
Braun's Holly Fern, *Polystichum Braunii.*

Dryopteris or Aspidium

New York Fern, *Dryopteris* or *Aspidium Noveboracensis.*
Marsh Shield-Fern, *Dryopteris* or *Aspidium Thelypteris.*
Massachusetts Shield-Fern, *Dryopteris* or *Aspidium simulata.*
Fragrant Shield-Fern, *Dryopteris* or *Aspidium fragrans.*
Crested Shield-Fern, *Dryopteris* or *Aspidium Cristata.*
Goldies Fern, *Dryopteris* or *Aspidium Goldieana.*
Evergreen or Marginal Wood-Fern, *Dryopteris* or *Aspidium marginalis.*
Male Fern, *Dryopteris* or *Aspidium Felix-Mas.*
Spinulose Wood-Fern, *Dryopteris* or *Aspidium spinulosa.*
Boott's Shield-Fern, *Dryopteris* or *Aspidium Boottii.*

Phegopteris

Long-Beech Fern, *Phegopteris phegopteris.*
Broad Beech-Fern, *Phegopteris hexagonoptera.*
Oak Fern, *Phegopteris Dryopteris.*

Woodwardia

Virginia Chain-Fern, *Woodwardia Virginica.*
Net-vein Chain-Fern, *Woodwardia areolata.*

Scolopendrium

Hart's Tongue, *Scolopendrium scolopendrium.*

Camptosorus

Walking Fern, *Camptosorus rhizophyllus.*

Asplenium

Pinnatified Spleenwort, *Asplenium pinnatifidum.*
Scott's Spleenwort, *Asplenium ebenoides.*
Small spleenwort, *Asplenium parvulum.*
Ebony Spleenwort, *Asplenium ebeneum.*
Maidenhair Spleenwort, *Asplenium Trichomanes.*
Green Spleenwort, *Asplenium viride.*
Narrow-leaved Spleenwort, *Asplenium angustifolium.*
Wall Rue, *Asplenium ruta-muraria.*
Mountain Spleenwort, *Asplenium montanum.*
Rock spleenwort, *Asplenium fontanum.*
Bradley's Spleenwort, *Asplenium Bradleyi.*
Silvery Spleenwort, *Asplenium acrostichoides.*
Lady Fern, *Asplenium Felix-foemina.*

Adiantum

Maidenhair Fern, *Adiantum pedatum.*
Venus-Hair Fern, *Adiantum Capillus-veneris.* (South and far West.)

Pteris

Bracken, *Pteris aquilina.*

Pellaea

Slender Cliff-Brake, *Pellaea Stelleri.*
Purple-stemmed Cliff-Brake, *Pellaea atropurpurea.*
Oregon Cliff-Brake, *Pellaea densa.*

Cheilanthes

Alabama Lip-Fern, *Cheilanthes Alabamensis.*
Hairy Lip-Fern, *Cheilanthes lanosa.*
Slender Lip-Fern, *Cheilanthes gracilis.*
Woolly Lip-Fern, *Cheilanthes tomentosa.*

Polypodium

Common Polypody, *Polypodium vulgare.*
Gray Polypody, *Polypodium polypodioides* (on trees in Gulf states).

Notholaena

Powdery Notholaena, *Notholaena nivea dealbata* (on calcareous rocks in southwestern states).

The angular-winged katydid and her eggs.
Comstock's Manual.

The Katydid

Florence White
Yorktown, N. Y.

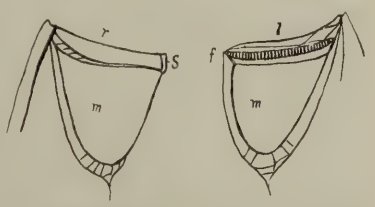
"I love to hear thine earnest voice,
Wherever thou art hid,
Thou testy little dogmatist,
Thou pretty katydid!
Thou mindest me of gentle folks—
Old gentle folks are they—
Thou says't an undisputed thing
In such a solemn way."—O. N. Holmes.

One of the memories of childhood is the song of the Katydid. Often have I lain awake and wondered what they were quarreling about. To be sure it is not a pleasant song but somehow a September evening would not seem complete if the Katydid orchestra did not join that of the crickets. Those who have never seen one of these beautiful creatures no doubt have very harsh feelings toward them. I wonder whether you have ever heard the

superstition connected with them? I have always heard that the Katydid was a herald of frost and that eight weeks from the time the first one is heard a frost may be expected in that particular region. Whether this be true or not I do not know, but as the Katydid does not appear until late summer and frosts come about the first of October there is not much ground for dispute.

One day last summer I saw one of these pretty pea green creatures. We were seated in a screened in porch when "thump" "zit" there on the screen sat one of these fiddlers. He had been attracted by the porch light of course and was quite unaware of my presence. Then the obliging creature, what did he do but start to fiddle! At such close range I should have been able to distinguish how he did it but all I could see was that he rubbed his upper wings together and made a rasping noise which I should call anything but beautiful. I cannot help agreeing with Mr. Scudder that the poets who sing its praises must have heard it at the distance that lends enchantment.

Notwithstanding its song the Katydid is a beautiful insect. To me it seems like an overgrown green grasshopper to which it is a cousin. It has two long legs to jump with and four shorter ones for clasping. The tarsi are four-jointed. The antennae longer than body are very slender and graceful. The oviposter is sword-shaped and often saw-like. The over wings or wing covers are stiffer than the under lace-like ones but the latter are longer so that they protrude beyond the upper ones. Margaret W. Morley compares the wings to skirts of bygone starched and stately dames, and yet the owner can fly through the air in a most pretty and ladylike fashion. The wing-covers, as may be supposed, furnish the instrument of music. On the right one may be found a more or less triangular area of membrane. and a very tiny scraper. On the left wing is a small file and a similar membrane. To make a noise the scraper on the right wing-cover is rubbed against the file on the left and so we get the rasping sound spoken of by Riley.



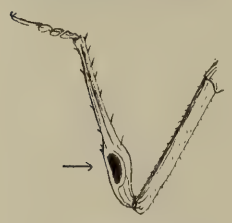
The front portions of the wings of a male katydid showing file on one wing and scraper on the other.

"The katydid is rasping at
The silence from the tangled broom."

and Elizabeth Akers,

"The Katydid with its rasping dry
Made forever the same reply
Which laughing voices would still deny."

Some people call the Katydid music love songs, and maybe they are. Why shouldn't a Katydid sing of such things as well as anybody else, only—well, I wish he had had his voice trained a little, don't you? You may hear these calls from dusk to morning from misdummer till frost; and not only you, but katydids can enjoy them also. They have ears on their forelegs. At the base of each fore tibia there is a thin place in the chitinized body wall (the tympanum) and a resonance chamber inside with a special arrangement of nerves and ganglia.



Front leg of katydid, showing ear near elbow. Comstock's Manual.

The katydids are very shy and with their protective coloring are not often seen. They seldom if ever sing in the daytime and only the males can sing. As a rule they live high up in dense forests and feed upon leaves and twigs often doing much damage but not as serious as that done by the grasshoppers, since they live singly or in pairs and never come in swarms.

The female lays her eggs above ground generally, according to the species. Some typical katydids deposit eggs on twigs of trees, the eggs being flat, oval and greyish brown (5.5 x 3 mm.). The angular-winged katydid described by Dr. C. V. Riley deposited her eggs on a twig. "Selecting a twig about the size of a common goose quill this provident mother prepares it for the reception of her eggs by biting and roughening the bark for a distance or two or three inches. This bite is not gradual like that when feeding, but is sudden and vigorous, the insect chewing and pressing the twig each side so as to form an edge. This operation is accompanied by a sudden nervous shake of the body from side to side and lasts sometimes but two or three minutes and sometimes more than ten. Then beginning at the lower end, she slowly curls the abdomen under until the lower edge of the curved ovipositor is brought between the jaws and palpi by which it is grasped and guided up and down from six to ten minutes while apparently from the ovipositor there issues a viscid liquid. Finally after a few seconds rest, the egg is deposited on the roughened surface in an oblique

position. After another rest the second egg is laid on the opposite side and a little above the first. The third is pushed in between the top of the first and the twig and alternately so that the eggs are not laid one on top of the other as supposed but rather one under the other. The eggs are deposited in September and hatch the following May and the young mature about the first of August. The young has no wings but it eats, grows and moults and when it sheds its skin for the last time it has wings.

In Florida the strong evergreen leaf of the orange makes an admirable resting place for the eggs of some species. This orderly katydid lays them in a row along the edge of the leaf.

The katydids belong to the family Locustidae of the order Orthoptera. The family includes the meadow grasshopper, cave crickets, wingless crickets, Jerusalem crickets, etc., but no locusts as one might suppose from the name. The katydids are various in form and name. There are the narrow-winged, round-winged, angular-winged, oblong-winged, broad-winged, and others according to the shapes of their wings. In the West there is a grey katydid which like its eastern cousins is very protectively colored.

And now, just to close with, I want to quote a few words about the song of the katydid because I like the way it is describe.

"The chances are that he who lies awake of a mid-summer's night must listen to an oft-repeated rasping song that says, 'Katy-did, Katy-did, she did, she didn't' over and over again. There is no use wondering what Katy did or didn't do for no mortal will ever know. If when morning comes the listener has eyes sharp enough to discern one of these singers among the leaves of some neighboring tree never a note of explanation will he get. The beautiful finely veined wings folded over the body keeps the secret hidden and the long antennae, looking like threads of living silk, still wave airily above the droll green eyes, as much as to say, 'Wouldn't you like to know'?"

A Fossiliferous Rock-Fragment from the Bed Rock
Underlying the Cornell Campus.

An Outline for the Study of Fossils

Carroll Lane Fenton
Charles City, Iowa

To most children, a fossil possesses a great deal of attraction. I have found that children who will turn away from a bird, a plant, or a shell, will stand for many minutes before a case of fossils. A

fossil represents to them all that is in a shell, except perhaps, the color. But it lived perhaps millions of years ago. That may seem nothing to some folks but it means much to a ten-year old child. When I was four years old, I saw a mounted skeleton of *Triceratops prorsus*. My parents pointed it out to me, and told me that it lived ages ago, and that it was once a great lizard (I thought it a skeleton of a rhinoceros). I remembered that skeleton. I remembered it so well that, four years later, I recognized it in a magazine plate, as *the Triceratops*. And I didn't remember it just as a lizard skeleton, but I remembered it by its name.

That point of remembering a name is a big one. Too many people are afraid of a name. "*Dinosaur*" is "one of those awful names" to be avoided. This is an error. A name is the handle for a plant or animal. We take hold of it by the name; we wield it, use it by the name. And once one tries to get along without names, he is lost. Also, a child likes a big word that he knows how to use. Teach him what it means, and he will know how to use it. Don't make the name the end, but make it a means to the end.

I find the school children have no horror of such a word as 'brachiopod' when they are told what it means, and why it is used. A seventh-grade boy whom I have endeavored to teach something of fossils speaks with ease of gasteropods, cephalopods, crinoids and trilobites. He knows what the words mean, and why they are used, and why they should be used.

(1) The first point I would make then, in teaching a child about fossils, is to teach him whatever technical names are necessary, and why they are necessary. And above all, teach him the meaning of the word 'fossil', and show how fossils are found in some of the famous fossil beds, and also how fossils are formed. And above all, also, remember that there is a difference sometimes between a fossil found in one bed and the same species found in another.

(2) Then, after the child has somewhat of an idea as to what a fossil is, and what some fossils are, how they are found, and how formed, show him a fossil bed. Before this, his knowledge, for the most part, has come from specimens. Now let him see some of these things as they are found. If you can't show him a fossil-bed, then use pictures and very few specimens at first, and bring out your specimens at this point. I find this method better than showing everything at the first.

If the child is going to show much interest, it will come out now. When he finds, or sees what he has before heard about, he is making a new discovery. He wants to see if what he heard is true, and he wants to find something that he hasn't seen, or heard about, before.

(3) Now I come to a point on which some may disagree with me; but nevertheless it works. Tell the child something that is not true, and then see that he, of his own accord proves that it isn't true. If you can show him some mistake in print, and let him find out by his own work that it is a mistake, so much the better. Of course you can see to it that he finds out and see to it that you do not make any great error in the statement, if your own. Its very interesting for the boy or girl who finds out that teacher made a mistake, or who finds something that teacher could not, but it's not nice for either pupil or teacher if the former decides that the latter "dunno anything, anyhow." That's why I say it's safe to let the pupil find someone else's mistake.

This is your "*piece de resistance.*" It is your final effort. After this it is easy sailing for you, and for the student. He now has not only found something out for himself, but he has found some thing that someone else did not find, and he feels that he has done something worth while.

(4) Now you may go on and tell him what is necessary about the relationship of the forms you are helping him study; how they lived, how they acted as their descendants today act, and how they developed one from another. If you can show a set of *Atrypa reticularis* Linn., that common Brachiopod of the Silurian and Devonian, and a set of *Atrypa hystrix* or, *Atrypa aspera* showing the relation, development and variation, do so. Do not discuss species, discuss orders or families, using species merely as examples

Your choice of fossils should be of course regulated by the formation in which you are situated. If you are in a Devonian locality, your specimens will be largely brachiopods, corals, molluscs, sponges, etc., while in Carboniferous you will be limited more to plants or in Tertiary to higher animals. Bring the study as near home as possible. Do not make things far away.

You will not teach the child to be a paleontologist; it would be impossible. If you get through with section four in a school year you will be accomplishing more than I have ever done. If you get well into section four you will be doing well. The walks

of course cannot stop, more names must be explained, and more discoveries made; and remember that he who makes a collection has more solid evidences of his work than he who doesn't Encourage your students to make little collections of their own, or for the class.

Also do not neglect the modern forms. A snail, an oyster, or a carriage sponge will help clear up many a question. An aquarium will help bring home the life at the bottom of the sea; a fern will make more real the *Pecopteris* of the Carboniferous.

This plan would probably have to be simplified for use in the lower grades. I have tested it particularly with students of the sixth, seventh and eighth grades, though I found the first three steps working well with some high-school students. Its purpose is to give an interest in fossils, coupled with a general knowledge of the activities, etc., of the forms studied. I believe, however that the first two steps, modified to suit the course, could be incorporated in high school courses in geology to some advantage.

Note

An extra supply of this issue is being printed. Any school that desires extra copies for class use should order at once.

The October Number will be a special Forestry Number.

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Asters

W. P. Alexander

Natural History Museum, Buffalo, N. Y.

"The lands are lit
With all the autumn blaze of Golden Rod
And everywhere the purple asters nod
And bend and wave and flit."—H. H.

Asters

The asters lend a crown of glory to the years most wholesome season, autumn. They are the children of the days when spring's opulence is past, and the busy summer has given way to the long full hours of fall, the richness of the ripening field and the hillside masked in gold. We speak of asters and the mind unconsciously feels the lure of September and October, on the substratum of our mental vision a picture is subtly woven by the alchemistic power of some irresistible spirit and the open road stretches away before us, banked to the right and to the left with endless vistas of regal bloom, that of the New England aster. We will study some of our commoner asters in this story, and if ought of queenly beauty argues for precedence, the stately New England aster easily takes the first place, and will here take its true rank and position.

Aster Novae-Angliae, except for the goldenrod is the most conspicuous and probably the most loved and admired flower of our northern hills in autumn. It blossoms from August to October but is seen in full perfection in our State about the middle of the latter month. The asters belong to the composite family and many of them are rarely beautiful while others lay claim to but few and modest charms. It is to the former category that must refer the New England aster. Its blossoms are about one inch broad, the disk flowers are rich and pleasing as seen massed together, and are uncommonly effective when the head first opens and the beauty of the 30–40 unrivaled ray flowers is still unimpaired; the rays close and open several times but it is only after their first opening that we can say that we have seen them in all that perfection implies. They are like magenta or purple stars. The firmament is hardly more fair to look upon when the night is unclouded than our fields in October when these stellar gems of the floral world spread far and near in endlessly beautiful and varied constellations. The New England aster is tall growing, the stem is much branched and its olive green soft-hairy leaves are easily seen from a considerable distance; the color of leaf and blossom blending harmoniously. Mable Osgood Wright says of it: "What a striking plant this is when seen standing in uncrowded groups close to the water." As it is often cultivated it is not uncommon in such groups, and fringing some sequestered pool in a garden, or out of it, where its rich purple can reflected mingle with the blue of quiet waters it is indeed a striking plant and one to be admired."

Of the 77 species of asters that are listed in Gray's Manual, a few stand out and may readily be recognized, most of them are hailed as welcome friends when they arrive, but botanically the group is so difficult to deal with that most of us are content to regard them merely as asters, things to consider aesthetically rather than studiously, and as a result of this attitude these rare plants are not nearly so intimately known individually as are some of the less common but more simple groups of flowers, our native orchids for example. The writer knows many unlettered persons who without hesitancy will point out the pink and yellow ladies' slipper and refer them to the orchid list but who cannot with certainty distinguish between the daisy flea-bane and our common white asters, calling them indiscriminately "little white daisies."

The Heart-leaved Aster (*Aster cordifolius*) although it is one of the small flowered asters is still worthy of more than passing notice.

It is modestly attractive, not all engrossing as is its imperious sister the New England, but quietly, pleasingly alluring. Its flower-heads, pale blue, are many and when met with in a dense mass, as we sometimes see it along the country roadside, it commends itself prettily to our interested eyes, and is withal a familiar sight. From its heart-shaped leaf and reddish stem this aster should be readily identified and called by its rather easy-to-remember common name.

The Aster family has a long blooming period, beginning with the Sharp-leaved Wood Aster and the Spreading Aster in early August and continuing to bloom heavily with sturdy grace up to November when the Michaelmas Daisy (*Aster Ericoides*) faints before the first snow, and the long active procession has passed. It is during our walks in the autumn woodland that we are pleased and surprised at times to chance upon a small, white aster with a shy nymph-like air and a countenance of spotless charm; it is our White Wood Aster (*Aster corymbosus*). Ellen Miller says of this haunter of sylvan ways: It is "perhaps the most daintily finished of the white asters, it is also the most shy, loving shady nooks and lonely places." We feel that Bliss Carmen has this same flower in mind when he wrote:

"The palish aster in the wood
A lyric touch of solitude."

There is something song-like,—of the nature of a cadence in the soft undulating sway of these Wood Asters, As we can conceive of a song without words, so in this enchanting blossom with its suggestive, harmoniously graceful lines, we can think of lyric loveliness without the intervention of lilting voice or soundng string. I hope that this aster will be one day, sought as ardently as is the violet that comes to gladden May.

As I stated in the beginning, Autumn is the time that might be called, the season of asters: the days begin to show a marked mood, indicating that something is taking place in the very heart of Nature's own being. Let us note in the words of Henry Ward Beecher, "the spent flowers, the seared leaves, the thinning tree tops, the morning frost, all have borne witness of a change on earth, Summer is gone, winter is coming." The signs of the season are these indeed, the spent flowers are on every side, and true also, the leaves are sere and falling, but look before you on the hillside or below you in the valley and there, belying the signs that mark

the year's decay you will see another aster, flourishing, and dauntless. It is the New York Aster (*Aster Novi-Belgii*). Gray calls it the "commonest late-flowered aster of the Atlantic border and the most variable." In spite of this charge of its being "common" and "variable" it is never-the-less an aster that we can think much of. The ray flowers are singularly beautiful and are usually of a tender violet, the color ranging through several shades in different localities. There are about 20 rays, sometimes less and often more; the leaves are lance-shaped and inclined to be clasping, the slightly toothed margins are not noticeable unless the plant is closely inspected. It is to be wished that every New Yorker might learn to know this attractive wild flower that has been popularly named for his home state.

An exceedingly interesting late flowering aster is the one which botanists have named *Aster patens* and is commonly spoken of as the Late Purple Aster. Found on high dry ground the tall commanding plant immediately arrests attention by its peculiar habit of flowering. The rich purple rays once they have planted their prettiness in the mellow autumn sunshine curl inwardly, clasping the disk flowers in a sort of tent-like covering, the effect is pleasing when a flowerhead is seen where a number of these closed blossoms mingle with an array of fully opened, princely flowers. The stem of this aster reaches a maximum height of three feet. The leaves are rather lance-shaped, inclined to be cordiform at the base and clasping. *Aster patens* is one that the writer feels should be better known, the tendency being to rather neglect it.

Bliss Carmen, singing of autumn, tells in a single verse the story of wonderous change working in the world at this season, aided by the hand of Flora: "From purple glory to scarlet pomp" runs the verse and we find no difficulty in refering the "purple glory" to the aureola of the New England Aster or if we have been mistaken there to the simpler crown of *Aster patens*, both fit the picture framed with the flame of red maples on the hill-top.

There are 12 asters quite common that the writer feels should be well known; they deserve some study and a little closer acquaintance than most of us have of them for it can not be denied that they are inclined to be friendly; they beset our paths on every side do we but venture forth beyond the limits of our town or city, nay, they spring up in our back yards or in our garden, looking us full in the face, craving as it were a little friendly attention, some

slight recognition. The list of these 12 follows in the order of importance that the writer regards them. 1. The New England. 2. The New York. 3. The White Wood. 4. The Heart-leaved. 5. Michaelmas Daisy. 6. Late Purple (A. patens). 7. Starry white (A. multiforns). 8. The Showy Aster (A. spectabilis) found only near the coast. 9. The Rough leaved (with dainty violet blur rays (*A. radula*). 10. *Aster loevis* (another light violet aster that seems to have no common name. 11. The Panicled (*A. paniculatus*). 12. And the Upland White Aster. That Ellen Miller describes as having "an individual excellence—existing especially in the curve of the leaf." Not a great deal to boast of most of us would say, but still there can be that excellence even in the curl of a leaf, a character so full of admirable grace that one can forget a paucity in the floral parts of a plant lost in the contemplation a sight equally beautiful. I have not spoken of the asters from a purely botanical point of view, and have not entered into the question of their method of reproducing their kind or how the wonderful flower that enters into the composition of the asters golden disk is made up. It would make an extensive and highly interesting study to discuss this phase of the composites, a family in which the asters take a high place; but the story has been told so often in a large number of text books and manuals that it is the better plan to let this remain a plea for closer acquaintanceship with the asters individually than a talk of flower parts in the language of the botanist.

It ought to make the walk afield more delightful, more full of real thrill and anticipatory excitement to see the asters in the distant meadows, and from afar, attempt to determine what particular one it may be from its height, form and color. The real pleasure comes in knowing that you have the skill to name these rare plants, and it loses none of its zest when one names the flower from the distant road and later learns that he has not been mistaken. Walks afield in the bright days of autumn are made lovely by the asters and we shall be the more elevated by these walks as we know these flowers and can name them as we name good friends.

News from Oregon

A part of a letter from JOHN W. THOMPSON

Clatskanie, Ore.

I am living on a piece of logged off land that has grown up in second growth. This growth furnishes admirable shelter and protection for many small denizens of the wood. I am going to do some close observation work as soon as I "get settled," as I have previously been a normal teacher, but have answered the call of the big out-doors, and now live here and teach a nearby rural school. I have two boys and two girls, the oldest, a boy of eight. Dallas Lore Sharp may wake up some morning and find he has a hitherto unknown brother on the "other side," near the Columbia and the Pacific.

After my school hours today I took a walk to see a neighbor in my own likeness, but in reality I observed many that were not like him, but were far more interesting. The band-tailed pigeon is quite common here, and I watched a large flock sitting quietly in the sun on the top limbs of a dead maple that stood near a patch of logged-off land. When one became hungry, he flew down to a large clump of blue-elders, and dined peacefully with robins, russet-back thrushes, and sparrows.

Since here I have seen mountain beavers, little spotted skunk, Oregon chipmunk, Douglas squirrel, California gray squirrel, one large mink, song sparrow, Oregon Junco, pine siskins, Oregon jays, blue-fronted jays, western horn owl, wood rat, kingfisher, Oregon towhee, varied thrush, russet-back thrush, hermit thrush, mountain quail, western blue-bird, western robin, Oregon chickadee, western house wren, cedar waxwings, violet-green swallow, red-winged blackbird, red-shafted flicker, northern pileated woodpecker, western rabbit, pigeon hawk, turkey vulture, China pheasant, and what surprised me most, was one morning I found what resembled the eastern flying squirrel. I have never known the range of the flying squirrel. Is there any species credited to this locality?

As Dallas Lore Sharp struggles against the fox, so my boys match their wits against the little spotted skunks, but with better success. They have caught six that will never trouble chickens again, and I am in danger of bankruptcy giving bounties if the supply of skunks is very much larger. Wood rats trapped also draw a bounty from my pocket, as there isn't a worse disturber of slumber

to be found than a wood rat running up squirrel-like the walls of the house in the dead of the night.

Well it is late, and as tomorrow is Saturday, I must rise early and walk six miles to mail this and other letters, and bring back sundry articles to last until another Saturday.

The Nature Guide Movement

Photo by Boysen's Studio

A field excursion under one of the Nature Guides in Yosemite National Park. The familiar outlines of the Yosemite Valley Rim shows in the background beyond the forest on the valley floor.

The Nature Guide Movement work in Yosemite was utilized during July by 1109 people daily. It is an outgrowth of similar work observed during recreation surveys of Norway and of Switzerland by a member of the Board of Directors of the Playground and Recreation Association of America. Out of the observations has come several concepts:

(1) The California Nature Study League, which supplies items concerning the ever changing pageant of nature to over 5000 schools, library centers, Boy Scout troops, and similar organizations throughout California.

(2) The offering of free nature study libraries at summer, also winter resorts.

(3) The Nature Guide Movement referred to above. Here highpower biologists from the Universities make plain to summer resort visitors the stories of the miracles of the out-of-doors. The work in Yosemite National Park this year is under the joint auspices of the National Park Service, of the Federal Government, of the California Fish and Game Commission, which is the state body charged with the conservation of the wild life there, and the California Nature Study League, the latter a volunteer organization which advocates and supports such concepts as the above, until the Federal or State Governments undertake them as a matter of government policy.

THE
NATURE-STUDY REVIEW

DEVOTED PRIMARILY TO ALL SCIENTIFIC STUDIES OF NATURE IN ELEMENTARY SCHOOLS

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Editorial

The Teacher and the Summer School

Doubtless the prevalence of summer schools now-a-days creates new problems for the teachers of the land, and they had problems a-plenty before. The first problem is "If I go to summer school will I have better prospects for advancement with the Board of Education?" The next is "How can I, after the hard work of the year, get a rest if I work during the hot weather?" The next is "Is this the best way to spend my hard earned savings?" It has been our privilege for many years to observe the way these first two problems are met by many teachers of varying ambitions and temperaments. Too often those of the most earnest and conscientious type make a fair start toward suicide in the six weeks devoted to hard study. They must get the full value of the money saved by care and sacrifice and they are attracted by many subjects, with the result that they take on loads that, in the end, prove to be crushing. They go home so tired that the two or three weeks, that intervene before they must begin work, prove entirely inadequate for the rest needed. The extreme antithesis to this type, of which there are few representatives, praise be!, come for a "good time." They take little work and that most casually and they had much better be at some social summer resort. There is a type between the two and its representatives are gaining in numbers, luckily. This teacher comes with the intention of resting much, working some and being entertained "a lot." She usually registers for credit in one or two courses, depending upon the amount of work involved. This one course she takes seriously and thoroughly making it a thread of interest on which to string the days of her six weeks; she registers for "attendance only" in such other courses as she feels drawn toward, but restricting the number so as not to fritter her strength and attention. Doing

a little work and that well done keeps the summer safe from disorganization and waste. She comes through serene, rejuvenated, and inspired afresh for the work of the year. In our opinion she has reached the right solution of the summer school problems although this solution is not for those who are working for degrees; theirs is quite another problem, which we shall not discuss here. But the fact remains that the summer school does its best for teachers when it gives them mental and physical recuperation

Frog Music

Mauree Applegate

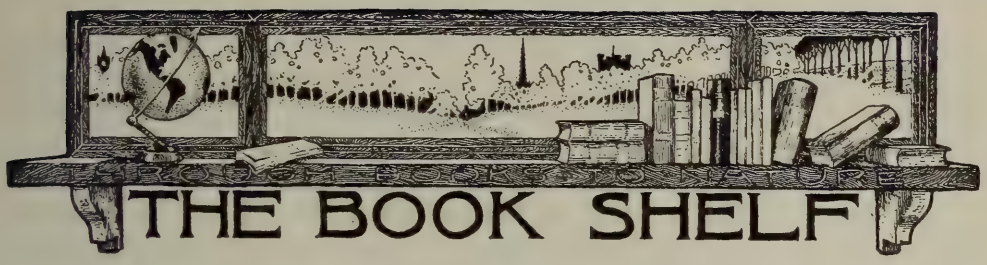
Plattsville, Wis.

You can talk about your robins
Singing, "Cheer up" from the tree,
But you know that kind of music
Don't appeal as much to me
As just to hear at evening time,
From some old mossy log
That soothing, restful singing
From the throat of some old frog.

There's nothing quite so peaceful
Along a winding road
As to drop down on the grass awhile
And lay aside your load.
Down beneath where bending willows
Lean across a muddy bog,
And listen to real music
As its rendered by the frog.

Oh, its something city dwellers
Don't sense the meaning of!
Just to feel the green beneath you
And the blue sky up above,
And everything so beautiful
Your being's all agog
To hear that soothing singing
From the musical old frog.

I suppose its sacrilegious!
But if ever I shall fly
Above those clouds, a-sailing
'Way up there in the sky.
I hope I'll be located
Near a green and mossy log
Where I can steal and lister
To the music of the frog.



A Little Gateway to Science. Edith M. Patch, State Entomologist of Maine, 180 pp. with many illustrations. Atlantic Press. School Edition, 90c., library, $1.25

So seldom is it that one who knows the facts of a science has the power of telling them interestingly to children that when such an one is found it makes an occasion for rejoicing. Miss Patch is a woman of high scientific attainments and is the only State Entomologist of her sex in the United States. Those of us who have been privileged to know her personally are not surprised to find that she can write such charming children's stories, for she possesses a certain childlike sincerity and sweetness of character that should make her the perfect interpreter to childhood. These stories she has given us from "Hexapod Land" are delightful from the first page to the last; each one is breathlessly interesting which is an important quality in a child's book; almost too interesting in fact, for we chanced to begin with the story of "Poly, The Easter Butterfly" and we read it over and over out of sheer enjoyment and almost forgot to read the other stories. The titles to the stories are most felicitous as are the names given to the insects, as "The Strange House of Cecid Cido Domy" for the story of the Cecidomyid that make the pine-cone willow gall; or "Lampy's Fourth of July" for the story of the Lampyrid beetle commonly called "Firefly." There are twelve of these stories, each one replete with the facts of insect life and each one as interesting as any fairy story ever written. The volume ends with some good advice to teachers and a helpful bibliography. We predict that a great many grown-ups will squeeze through "The Little Gateway to Science" and revel with the children in "Hexapod Land"; anyway it is a volume that should be in every school library and every child's own library as well, for it is a *great* little book.

The Adventures of a Nature Guide. Enos A. Mills, 271 pp., 30 full page illustrations from photographs, Doubleday Page & Co.

When Enos Mills writes a book we may always be certain that it is a truthful record of the life and the happenings in the mountain wilderness. All of his books should be in every school library, but perhaps this volume contains the most important message of any for the teacher. Each chapter holds the reader's interest to the last word. The beginning chapters tell of mountain experiences: "Snow-blinded on the Summit," "Winter Mountaineering," "Trees at Timberline," "Wind-rapids on the Heights," "The Arctic Zone of High Mountains. The chapters of greatest importance for the Nature-Study teacher are "Waiting in the Wilderness" which illustrates how to really observe the life of the woods and fields; "The Children of My Trail School" which gives an account of Mr. Mills' methods of teaching children wood lore and

proves him to be an ideal nature study teacher; "Harriet, Little Mountain Climber" which gives a detailed account of the ascent of Longs Peak by Mr. Mills with six year old Harriet Peters which is a revelation of the ability of the small child for mountaineering.

For the world at large the most important chapter is "The Evolution of Nature Guiding" which voices the long-felt want for guides who know the animals, birds, trees, plants and geology of the wilderness. Mr. Mills says:

"It is probable that nature guiding will become a nation-wide and distinct profession, and, though different, rank with the occupations of authors and lecturers. A nature guide is a naturalist who can guide others to the secrets of nature. Every plant and animal, every stream and stone, has a number of fascinating facts associated with it and about each there are numberless stories."

We predict that this volume will have a wide and beneficient influence for it is sure to be as useful as it is interesting.

Zoology, A Textbook for Colleges and Universities, by T. D. A. Cockerell, Professor of Zoology, University of Colorado, pages i–xii, 1–558, figures 211, World Book Company, Yonkers-on-Hudson, New York, 1920.

This volume is a comprehensive, philosophical resume of life reaching back to the lowly protozoa and from this basis tracing various lines of development and discussing the more important factors which have played a part in the modification of life. It differs widely from many zoologies in that great stress is laid upon the vital reactions and comparatively little space devoted to the purely systematic. It is a discussion of characteristic types of developing life rather than a record of conditions in existence at a stated period. The author keeps the mutability of life constantly before the reader. It is a human document, a digest of man's interpretation of the animal world and as such, it occasionally turns from the purely zoological to sympathetic and inspiring accounts of the life work of such master builders as Mendel, Charles Darwin, Linnaeus, Fabre, Pasteur, Louis Agassiz and Baird and here and there one may find evidences of the author's personal contributions to a better explanation of the mysteries of life.

An excellent idea of the scope of the work outside the usual zoological divisions may be obtained from a scrutiny of certain chapters as for example: The Physical Universe, a few pages defining the place of life in the universe. The Living Substance, a suggestive discourse on protoplasm. The Cell and Its Activities, an exposition of the possibilities and limitations of the cell. Respiration, a discussion of the fundamentals and variations in this function. Mendelism, a brief presentation of certain laws of heredity. Social life, an outline of community activities and their expression in man. Alcohol and Heredity, a suggestive explanation of the injurious effects following the use of alcohol. Natural Selection, a summation of the important factors affecting development. The Florissant Shales of Colorado, a brief account of one of nature's treasure houses. The Evolution of Man, a recapitulation of the principal stages in the development of the human type. The Biological Regions of the World, a descriptive outline of the chief faunal areas. History from a Biological Point of View, a plea for the recognition of the historical value of biological changes or reactions and their effect upon nations. All of

these and other chapters have much of interest for the general reader and present matter which cannot fail to stimulate both professor and student

The book makes a strong appeal for the recognition of zoology in its broader sense and presents in a most convincing manner the intimate relations existing between the reaction of animals to environment and the welfare of man. It may be characterized as an inspiring interpretation of animal life in its broadest phases by one keenly interested in explaining the problems and guided by a reverent appreciation for truth, the unrevealed as well as the known. It would not be surprising if this little volume came to be regarded as one of the treasure books of science, since it presents a most attractive picture of animal life (including man) and cannot fail to stimulate those who desire to take part in solving the many mysteries of nature.

E. P. Felt.

Joseph Dalton Hooker, by Prof. F. O. Bower, Regins Professor of Botany in the University of Glasgow. 62 pp. London, Society for Promoting Christian Knowledge, New York, The MacMillan Co.

The biography of a man who has done things is always interesting, especially when written by one who is a master of the craft. The little book which bears the above title is the fascinating story of the life of one of the great men of his time. Many men of science, as well as the successful in other fields of endeavor have won their way in the face of obstacles by their unaided ability and the genius which consists in "the capacity for work," but Joseph Hooker who indeed possessed that genius had also the early advantages of favorable inheritance and fostering environment. Both grandfathers were naturalists and his father was Sir William Jackson Hooker, F.R.S., for twenty years Regins Professor of Botany in the University of Glasgow and afterward director till his death of the Royal Gardens at Kew.

His formal education consisted in attendance at the Glasgow High School and afterwards the attaining of degrees at the University, but his most valuable scientific education came through association with his father. He and his brother aged seven and eight, respectively, used to attend their father's eight o'clock lectures and the boys were allowed to go with their father and his students on their collecting trips around Glasgow on summer excursions into the Highlands. There experiences in roughing it stood him in good stead on his arduous journeys in the Antarctic, the Himalayas and, later, on the trip that he made when he was sixty years old in the company of our own Asa Gray, his longtime friend, into the Rockies and the Sierras of the Western United States and in California.

He was a lifelong, close, and sympathetic friend of Charles Darwin and his powerful champion. He was associated with him in the period of labor and struggle when he was working out the origin of species. The chapter on "The Species Question" vividly summarizes this part in the life of Hooker. "The great bulk of Joseph Hooker's works were written frankly as a botanist for botanists," "Few ever have known plants, few ever will know them, as Hooker knew them. Such knowledge comes only from growing up with them from earliest childhood as he did." But he was no mere specialist. "His topographical work in Sikkin (India) would have given him a place as geographer. His observations of the effects of denudation in the Himalayas

and on the deep sea deposits in the Antarctic would have given him a footing as a geologist for his studies of the ooze of the sea floor introduced that field to geologists. He interested himself in all forms of organic life and found fascinating problems in the floating plankton of both warm and cold oceans.

He was a member of the famous Ross expedition (as naval surgeon to the ship *Erebus*) which added so much to the geography of the world. The results of this expedition led him to make the journey to the Himalayas where he proved what he had suspected that the zones of life from base to summit of tropical mountains correspond with the horizontal zones from tropics to poles. His method of study was what is now known as ecological.

The chapter on Kew, the famous garden with which his name as well as that of his distinguished father is forever associated is especially interesting. This great botanical garden, at first the mere appanage of a royal residence and containing only about 18 acres, has been extended till now it includes some 650 acres, with an herbarium building, museums, and conservatories, while the staff is above one hundred men.

To enumerate a few of his long list of honors, Sir Joseph Hooker succeeded his father as Director of Kew in 1865. He received in 1873 the highest honors in the gift of Great Britain in science when he was made president of the Royal Society, received the Royal Medal (1854), the Copley Medal (1887) the Darwin Medal (1892).

He died on December 11, 1911, at the age of 94, "full of years and honors" and was buried beside his father at Kew.

The value of this brief biography is enhanced by a page of dates relating to his official and scientific life, a list of portraits, and a bibliography. A portrait faces the title page.

M. E. H.

Memories of the Months, Sixth Series. By Sir Herbert Maxwell. Published by Edward Arnold, London. Longmans-Green and Co. Price, $3.75 net.

As the title suggests, there are twelve divisions of the book, corresponding to the number of months of the year. The author states in the preface that the book is in the form of notes bearing upon a variety of phenomena and incidents dealing, for the most part, with out-of-door life. There is an occasional article not concerned with nature, however, such as "The Art of Blazon," in which Sir Herbert discourses at some length about heraldry.

Under the heading of each month are three or four short sketches chosen apparently at random with no possible connection save that of the time of year. In the month of April, for instance, Sir Herbert begins with a description of a thrush's nest and proceeds from that to write of the, in his opinion, laudable tendency to return to informal gardens in England, and then passes abruptly to a discussion of the clan of herbs known as Cross-bearers.

The book contains interesting bits of information about a variety of subjects, such as pheasants, lilies, the food of otters, and animal intelligence. There are delightful bits of quiet humor and there is a refreshing originality in the author's treatment of the subjects which should make the book appeal not only to the student of nature but to the average man who is a lover of nature.

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Yellow Birch

Photo by Verne Morton

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Staminate Blossoms of White Ash.
Photo by G. F. Morgan

TABLE OF CONTENTS

The American Ash—Mae Creswell - - - 279
The Birch Tree—Poem - - - - 284
What a Tree is and how it Grows - - - - 285
A Graded Course in Tree-Study - - - - 290
Leaf Prints - - - - - 297
Suggestions for Forestry Study in the English Grade or First Year High School—George H. Russell - - - 300
The Teaching of Plant Diseases in the Grades —William Gould Vinal 303
The Birches—H. Marguerite Hess - - - 307
Putting "Pep" into the Field Trip—C. C. Leeson - - 317
Editorial - - - - - - 319
Book Shelf - - - - - - 321

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THE
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VOL. 16 OCTOBER, 1920 No. 7

*The American Ash

MAE CRESWELL
Cedar Falls, Ia.

During the boyhood of Hiawatha, his teacher Iagoo trained the future warrior, taught him to make and to use the bow and arrow.

"Made a bow for Hiawatha
From a branch of ash he made it."

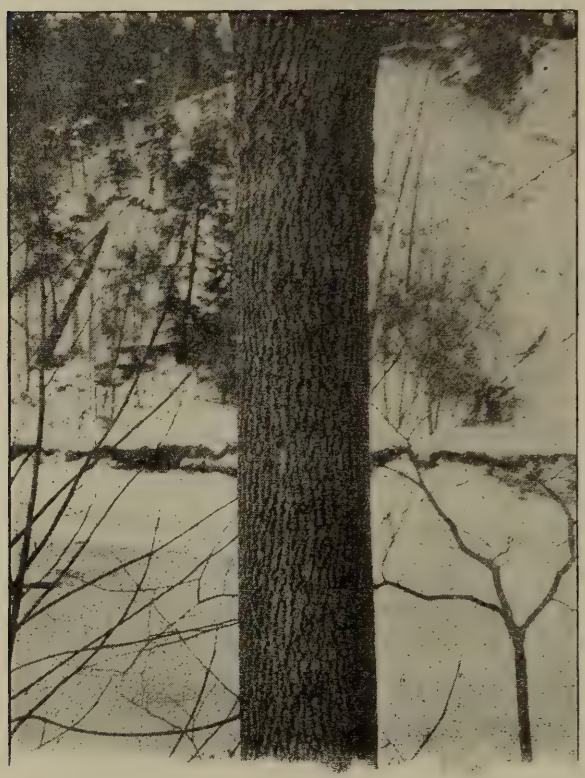
Just as the primitive man went to the ash for his bows and canoe paddles so the pioneer made use of its wood in forming his simple tools of conquest and we the creatures of our highly organized civilization get from its wood parts of many of the machines for production; for the same qualities that made it desirable for the bow or pitch-fork handle also make it valuable in hammer handle, carriage tongue or automobile.

The ash is like some reliable friend to whom we turn in time of need or trouble. It never makes much show or demonstration, but is one of the quiet reliable friends that we may trust.

The American or white ash, *Fraxinus Amercana* is found only in North America. It occurs from Nova Scotia westward to about the ninty-fifth meridian and south to Georgia and Texas, but the finest trees are in the Ohio Valley where it sometimes grows to be 120 feet tall and six feet through. Usually it does not get to be over 60 or 80 feet high and two or three feet in diameter. Ash trees are inhabitants of the North Temperate zone; species closely related to ours grow in the forests of Central and Northern Europe. Our ash chooses rich, moist, well-drained snil but makes a slow but sure growth in thin or poor soil. It is found intermingled with other deciduous trees, never in pure stands.

*This is the last of a series of articles written for THE REVIEW by Miss Cresswell before her death which took from this world a remarkably able naturalist and an excellent teacher.

The Indian had no trouble in recognizing the ash in the forest. Its pattern against the sky is so characteristic as to be distinguished easily at considerable distance. The twigs are few, stout and in pairs that extend outward and upward with a sturdiness not even approached by other trees. There is no great mass of twigs produced to be starved in numbers after a year or two. In the open, the tree forms an oval outline; but in the forest, the trunk is long, straight with a pyramidal crown. The bark is grayish brown and finely fissured in such even diamond shaped areas as to resemble smocking. There is nothing untidy or neglected-looking about this tree from its tipmost bud down to the turf at its base. The branches are a smooth brownish gray with twigs that are a soft gray often with a delicate bloom on them. They are usually long between the nodes and slightly flattened at the nodes.



Bole of white ash showing the beautiful bark.
Photo by Ralph Curtis.

The buds are opposite, brown and ovate and sit like tiny dumpy, brown gnomes in round brown velvet hoods above the large semi-circular leaf-scars that are notched at the top. Usually there are three buds at the end of the twig; the terminal bud in the middle is the largest bud on the twig.

Spring time is surely here when the ash buds open. One may often fear the ash is dead since it is so slow in responding to Spring's call. A prudent tree is this one, it waits until spring is really here before uncovering its dainty, fragile, glisteny new leaves.

"O laggard still, though other trees
Have donned their vernal liveries,

> The dainty ash at length receives
> Her graceful garment of leaves."

sings the impractical poet; Tennyson also reminds us of its late opening when he speaks of a lady who did not yield to wooing in comparison with ash;

> "Why lingereth she to clothe her heart with love,
> Delaying as the tender ash delays
> To clothe herself, when all the woods are green?"

The result is worth the waiting. For a time it is clad in an exquisite garment of filmy lacy pale green. Soon the foliage takes on a firmer texture and becomes a smooth deep green showing slightly paler beneath. The compound leaves are in pairs mostly near the ends of the branches, hence it always has an open effect when viewed from below.

The leaves are from eight to twelve inches long with stout petioles and five to nine leaflets each on its own short petiole. The leaflets are from three to five inches long and half as broad, taper pointed, entire or indistinctly serrate. The end one is the largest and the basal pair, the smallest.

Along with the lacework of leaves come the flowers. The deep blackish purple clusters of staminate flowers are on one tree and the loose drooping wiry-looking boquets of purplish green pistillate blossoms are on another tree. The staminate flowers have not much beauty to boast of. They are a clustered mass of simple flowers, each consisting of a tiny calyx and two or three stamens with stout thick anthers and very short filaments. The blackish purple tint gives way to pale gold as the anthers open and display their wealth of pollen to the spring breezes. The pistillate flowers are also only the calyx and essential pistil, a tiny urn sitting on a pedicel, or rather pedicel and urn both hang in almost any direction. The stigmas are two, long and dark purple in color, placed right on top of the ovary. Two tiny seedlets reside inside the urn but only one gets a chance to grow. The ash does not offer special attractions to the insects to get them to carry her pollen but depends upon the fickle wind. As a result of this lack of advertising, the harvest of fertile ash seeds is often small. Many seeds are produced, but only about one-third of them have power to grow.

The foliage keeps its smooth deep green appearance all summer. The hanging bouquets of seed keys are a pale green with often a faint rose tint until they mature and turn yellow in late September. The autumn tints of the ash fail to follow the prevailing fashions of yellow, crimson and brown, but it assumes a hue characteristically its own, a purplish robe with a lining of pale gold. The upper and outer leaves of the tree show the deep purplish and maroon tones on the upper surfaces of leaflets and petioles while the undersides are pale gold as are also the leaves in the inner part of the tree. This gives a peculiar lighting effect that is seen in no other part of the gorgeous autumn landscape. Burroughs says, "The ash has been less noted for its autumnal foliage than it deserves. The richest shades of plum color, becoming by and by in certain light a rich maroon—are afforded this tree. Then at a distance there seems to be a sort of bloom upon it, as upon the grape or plum."

The leaves fall soon after the first hard frost leaving the clusters of seeds to float down leisurely through the winter. Each fruit has an oar-shaped wing with the seed in the small end. The wing is evenly balanced so the ash fruit does not whirl as it courses its way downward, but even on very quiet days this wing causes it to alight at considerable distance to one side of the place where it started. And when the wind blows, well, that depends upon the blast. The thoroughness of distribution is shown by the frequent occurrence of ash seedlings at considerable distance from any fruit bearing tree.

The wood of the ash is heavy, hard, strong, elastic, close-grained easily worked but does not endure in contact with soil. Quality not quantity is ever the watchword of the ash. Rapid growing ash wood is best since the proportion of close grained summer wood to the more open porous spring wood is greater than in trees of slow growth.

In earlier days, it was used for handles of tools, wagon tongues, stakes, pins, ox-bows, staves, while the modern man uses it in his farm machines, wagons and automobiles. An advertisement in a local paper recently asking for young ash poles was signed by a firm that is known to be exerting all its energies to the manufacture of aeroplanes. Thus the ash goes into the modern American's implements of warfare and transportation. The wood is known as a sanitary wood, that is, it does not taint food in contact with

it, hence the most important use for ash in the dairy regions is for butter tubs. Michigan sells her ash in the form of automobiles; Arkansas for tool-handles; Louisiana for oars; Massachusetts in furniture; the Carolinas in wagons and Texas as boxes and crates.

The ash is very free from attacks by insect and fungi and bears transplanting well. These qualities with its beautiful foliage that is not so dense as to prevent grass growing under it make it an excellent tree for street or park planting.

A curious little mite finds its way into the staminate flowers and the flower cluster seems to do its best to care for the tiny parasite, leastwise instead of dropping off when its pollen is discharged as any well-behaved staminate flower should, stays on until the next spring and grows into a mass of brown material resembling a witch's broom. In this the mite resides until the new flower cluster is ready for occupancy.

Trees have ever had their place in the mythology of man and the ash has had its part. Not much of this came to the practical American but one saying refers to the foretelling of the weather.

> "If the oak is out before the ash,
> 'Twill be a summer of wet and splash;
> But if the ash is out before the oak,
> 'Twill be a summer of fire and smoke."

One needs but to go to the records of ancient Scandinavian Europe, the home of vikings and sagas, to find the ash the center of worship as was the oak to the tribes southward. To them all life came from the sacred ash Ygdrasil. It supported the whole universe, one of its huge roots reached to the realm of the gods, another to the realm of wisdom and wit among the giants and the third into the region of darkness where a huge dragon fed constantly upon its roots. These Norsemen, or Vikings are referred to by Bishop Adams of Bremen as Aschmen (ashmen) possibly because as Edda narrates, the first man was fashioned from ash; or possibly because they carried ashen spears.

Pliny says a snake would as soon crawl thru fire as thru an ash tree.

As the myth is replaced by the practical, so grows man's appreciation of this tree since it contributes so ably to his ever extending means of production to his comfort by giving him safe vehicles for rapid transportation in canoe, wagon, carriage, automobile or air-

craft, or a fire wood equalled by only a few other woods; also a shade for his protection and for his enjoyment by lending beauty to his landscape. Whether it be in his door yard, the street or woods—every day of the year the ash is man's friend and worth knowing.

The Birch Tree

JAMES RUSSELL LOWELL

Rippling thru the branches goes the sunshine,
Among the leaves that palpitate forever;
Ovid in thee a pining nymph had prisoned,
The soul once of some tremulous inland river,
Quivering to tell the woe, but, ah! dumb, dumb—forever!

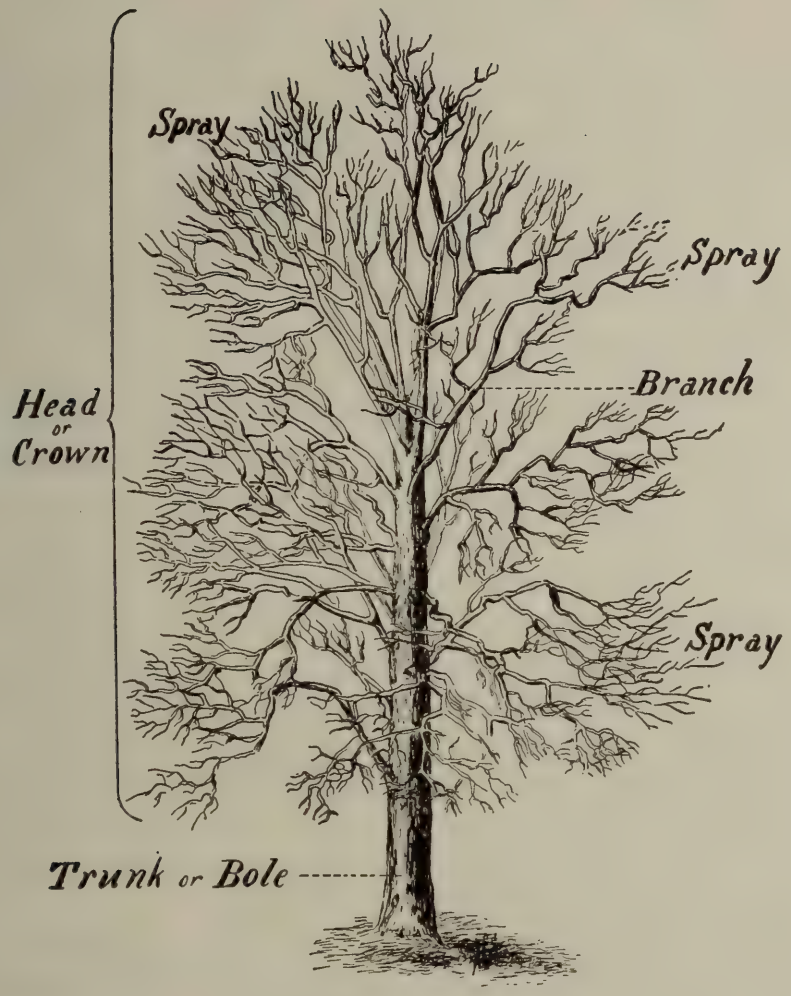
While all the forest, witched with slumberous moonshine,
Holds up its leaves in happy, happy silence,
Waiting the dew, with breath and pulse suspended,
I hear afar thy whispering, gleamy islands,
And track thee wakeful still amid the wide-hung silence.

Upon the brink of some wood-nestled lakelet,
Thy foliage, like the tresses of a Dryad,
Dripping about thy slim white stem whose shadow
Slopes quivering down the water's dusky quiet,
Thou shrink'st as on her bath's edge would some startled Dryad.

Thou art the go-between of rustic lovers;
Thy white bark has their secrets in its keeping;
Reuben writes here the happy name of Patience,
And thy lithe boughs hang murmuring and weeping
Above her as she steals the mystery from thy keeping.

Thou art to me like my beloved maiden,
So frankly coy, so full of trembly confidences;
Thy shadow scarce seems shade, thy pattering leaflets
Sprinkle their gathered sunshine o'er my senses,
And nature gives me all her summer confidences.

Whether my heart with hope or sorrow tremble,
Thou sympathizest still; wild and unquiet,
I fling me down; thy ripple, like a river,
Flows valleyward, where calmness is, and by it
My heart is floated down into the land of quiet.



A tree with parts named.

What a Tree is, and How it Grows

First of all a tree is a living, breathing, feeding, growing being, capable of adapting itself to varied conditions, and capable of successful struggle against adverse circumstances.

A white ash in view from my window borders the lawn on its north side and has scarlet oaks for near neighbors on the south, and each of its branches and twigs reach out to the north, so it has a beautiful well rounded head on that side but is flat on the side of the oaks as if it had been sliced off with a giant knife. Every tree should be studied sympathetically in an endeavor to understand how it has conquered its difficulties, and overcome obstacles.

The Parts of the Tree

The *head* or *crown* is composed of the branches as a whole, which in turn are composed of the larger and smaller branches and

twigs. The *spray* is the term given to the outer twigs, the finest divisions of the trunk, which bear the leaves and fruit. The branches are divisions of the *bole* or *trunk* which is the body, or stem, of the tree. The bole, at the base, divides into roots, and the roots into rootlets, which are covered with root-hairs. It is important to understand what each of the parts of a tree's anatomy does to help carry on the life of the tree.

The roots which extend out in every direction beneath the surface of the ground, have two quite different offices to perform: First, they absorb the water which contains the tree food dissolved from the soil; secondly, they hold the tree in place against the onslaught of the winds. If we could see a tree standing on its head with its roots spread in the air in the same manner as they are in the ground, we could then better understand that there is as much of the tree hidden below ground as there is in sight above ground, although of quite different shape, being flatter and in a more dense mass. The roots seem to know in which direction to grow to reach water; thus, the larger number of the roots of a tree are often found to extend out toward a stream flowing perhaps some distance from the tree; when they find plenty of food and water the rootlets interlace forming a solid mat.

To understand how firm a base the roots form to hold up the tall trunk, we need to see an uprooted tree. The great roots seem to be molded to take firm grasp upon the soil.

The trunk or bole or stem of the tree has also two chief offices: It holds the branches aloft, rising to a sufficient height in the forest so that its head shall push through the leaf canopy and expose the leaves to the sunlight. It is also a channel by which the water containing the food surges from root to leaf and back again through each growing part. The branches are divisions of the trunk, and have the same work to do.

In cross-section, the tree trunk shows on the outside the layer of protective bark; next to this comes the *cambium layer* which is the vital part of the trunk; it builds on its outside a layer of bark, and on its inside a layer of wood around the trunk. Just within the cambium layer is a lighter colored portion of the trunk, which is called the *sap-wood* because it is filled with sap which moves up and down its cells in a mysterious manner; the sap-wood consists of the more recent annual rings of growth. Within the sap-wood are concentric rings to the very center or pith; this portion is

usually darker in color and is called the *heartwood;* it no longer has anything to do with the life of the tree, but simply gives to it strength and staunchness. The larger branches, if cut across, shows the same structure as the trunk,—the bark on the outside, the cambium layer next, and within this the rings of annual growth. Even the smaller branches and twigs show similar structure, but they are young and have not attained many annual rings.

The leaves are borne on the outermost parts of the tree. A leaf cannot grow, and if it could would be of no use, unless it can be reached by the sunlight. Therefore the trunk lifts the branches aloft, and the branches hold the twigs far out, and the twigs divide into the fine spray, so as to spread the leaves and hold them out into the sunshine.

In structure, the leaf is made up of the stem, or *petiole* and the *blade*, or widened portion of the leaf, which is sustained usually with a framework of many ribs or *veins*. The petioles and the veins are sap channels like the branches and twigs.

The Way a Tree Grows

The place of growth on a tree may be found at the tips of the twigs and the tips of the rootlets; each year through this growth the tree pushes up higher, down deeper and out farther at the sides. But in addition to all of these growing tips, there is a layer of growth over the entire tree—over every root, over the trunk, over the limbs and over each least twig, just as if a thick coat of paint had been put over the complete tree. It is a coat of growth instead, and these coats of growth make the concentric rings which we see when the trunks or branches are cut across. Such growth as this cannot be made without food; but the tree can take only liquid food from the soil; the root-hairs take up the water in which the "fertilizer" is dissolved, and it is carried up through the larger roots, up through the sap-wood of the trunk, out through the branches to the leaves, where in the leaf-factories the water and free oxygen is given off to the air, and the nourishing elements retained and mixed with certain chemical elements of the air, thus becoming tree food. The leaf is a factory; the green pulp in the leaf cells is part of the machinery; the machinery is set in motion by sunshine power; the raw materials are taken from the

air and from the sap containing food from the soil; the finished product is largely starch. Thus, it is well, when we begin the study of the tree, to notice that the leaves are so arranged as to gain all the sunlight possible, for without sunlight the starch factories would be obliged to "shut down." It has been estimated that on a mature maple of vigorous growth there is exposed to the sun nearly a half acre of leaf surface. Our tree appears to us in a new phase when we think of it as a starch factory covering half an acre.

A stump showing rings of growth.

Starch is plant food in a convenient form for storage, and it is stored in sapwood of the limbs, the branches and trunk, to be used for the growth of the next year's leaves. But starch cannot be assimilated by plants in this form, it must be changed to sugar before it may be used to build up the plant tissues. So the leaves are obliged to perform the office of stomach and digest the food they have made for the tree's use. In the mysterious laboratory of the leaf-cells, the starch is changed to sugar; and nitrogen, sulphur, phosphorus and other substances are taken from the sap and starch added to them, and thus are made the proteids which form another part of the tree's diet. It is interesting to note that while the starch factories can operate only in the sunlight, the leaves can digest the food and it can be transported and used in the growing

tissues in the *dark*. The leaves are also an aid to the tree in breathing, but they are not especially the lungs of the tree. The tree breathes in certain respects as we do; it takes in oxygen and gives off carbondioxid; but the air containing the oxygen is taken in through the numerous pores in the leaves called stomata, and also through lenticels in the bark; so the tree really breathes all over its active surface.

The tree is a rapid worker and achieves most of its growth and does most of its work by midsummer. The autumn leaf which is so beautiful has completed its work. The green starch-machinery or chlorophyl, the living protoplasm in the leaf cells, has been withdrawn and is safely secluded in the woody part of the tree. The autumn leaf which glows gold or red, has in it only the material which the tree can no longer use. It is a mistake to believe that the frost causes the brilliant colors of autumn foliage; they are caused by the natural old age and death of the leaves—and where is there to be found old age and death more beautiful? When the leaf assumes its bright colors, it is making ready to depart from the tree; a thin, corky layer is being developed between its petiole and the twig, and when this is perfected, the leaf drops from its own weight or the touch of the slightest breeze.

A tree, growing in open ground, records in its shape, the direction of the prevailing winds. It grows more luxuriantly on the leeward side. It touches the heart of the one who loves trees to note their sturdy endurance of the onslaughts of this their most ancient enemy.

October

THOMAS STEPHENS COLLIER

A birdnote sounding here and there,
  A bloom, where leaves are brown and sober,
Warm noons, and nights with frosty air,
  And loaded wagons say,—October.

A Foretaste.
Photo by Verne Morton.

A Graded Course in Tree Study

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The autumn is the best time of the school year for beginning tree study; although in some grades the subject should be given attention every month, yet the greater interest in trees centers at the time of year when their foliage attracts the eye and wins admiration from even the most unimaginative.

Kindergarten and First Grade.—The objects to be achieved in the kindergarten and the first grade are to make the pupils acquainted with the leaves of our more common trees and to make them interested in one or two individual trees and what happens to these trees each season. of the year.

To accomplish these objects we use various devices and methods and the following suggestions will be found useful.

Let the children bring to school leaves of all sorts, which have autumn tints. They will be especially interested in picking up the bright colored leaves that fall from the roadside trees.

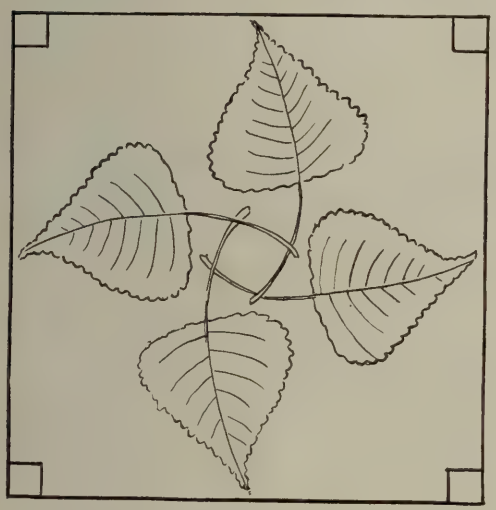
Let them classify the leaves according to color so as to train the eye to discriminate the tints and color values.

Let them classify leaves according to form, selecting those which resemble each other.

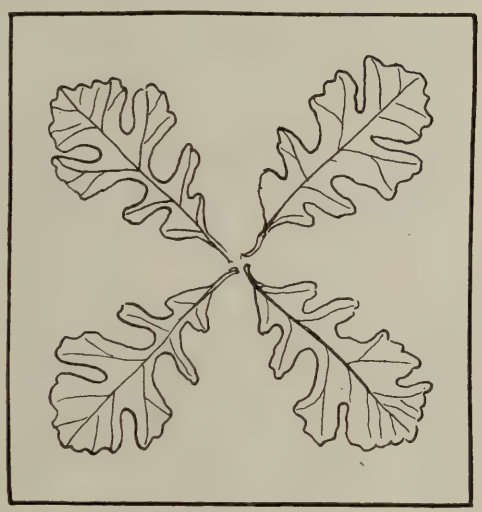
Have them tell in what respects they resemble each other, in this way incidentally calling attention to the margins, the veins and the petiole.

Teach the names of the leaves of the most common trees by mentioning *quite incidentally* that certain noticeable leaves are the maple or oak or elm, etc. The children will quickly pick up these names by themselves if thus taught, and the knowledge will help them later on.

Let each child select a leaf of his own choosing and draw it. This may be done by placing the leaf flat on paper and outlining it with a pencil, later drawing in the veins, or the drawing may be made with colored crayon freehand. The pupils should be allowed



Leaves of cottonwood mounted on card.



Leaves of mossy cup oak mounted on card.

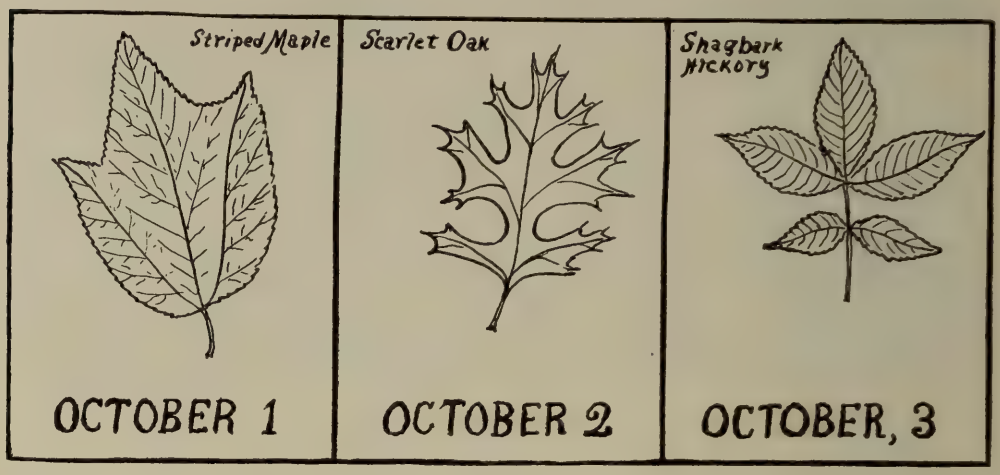
to please themselves in this matter, as it is not a drawing lesson but a lesson to help remember form and color.

Let the pupils select paper of a color similar to the leaf and cut out the leaf from it during busy work.

Let each pupil select four leaves of maple or oak as nearly similar as possible and press them in his book, and later arrange them on a card in some symmetrical design. This may be done while the leaves are fresh, and the card thus arranged may be pressed and thus preserved.

Third Grade.—The work for the third grade should be an October calendar with a leaf mounted and labeled for each school day of the month. The leaves may be pressed and mounted upon a card, or the leaf may be traced in outline and colored in crayon, or merely traced with the veins drawn in. If there are not thirty species of trees available about the schoolhouse, two leaves of the

same species may be used. These two leaves may show the variety in coloring or they may offer a contrast in size and in form since no two leaves are exactly alike, and this in itself is a good lesson.



A leaf calendar for October.

The cards for the calendars should be of uniform size and if it is possible, the calendar should be made into a frieze and pinned to the walls. This will give the children an opportunity to study those leaves already used and will stimulate them to search for different kinds of leaves.

The learning of the names of trees should never be in the form of a task or a lesson but should always be given in the form of a game. After the children have traced many leaves put the drawings in a pile and then for busy work ask a child to go to the pile and pick out all the maple leaves or the poplar or sycamore, etc. leaves of the pile.

Select some tree near the schoolyard which may be observed from a window, give it a name and try to impress upon the children that it is a living being in some measure like themselves. The following observations should be made at appropriate times during the year. The color of the tree during October, the shape of the trees with the leaves on which should be shown in a sketch, any birds or animals or insects which may be found visiting the tree, the shadow cast by the tree and the kind of plants that grow beneath it, its fruits if they are ripe at this period.

In the winter the tree should be sketched again with special attention to the shape of its trunk and branches. Note if the snow remains on the tree after it falls. In March bring in some twigs

from the tree and put them in water and let the pupils see the young leaves burst the bud scales and expand. Later call their attention to the color of the young leaves and a sketch should be made of the tree in May when it is again in full leaf.

Fourth Grade.—In this grade the pupils should learn to distinguish the different kinds of maples, oaks, poplars, and pines which are common in the locality. This may be accomplished by a collection of leaves, each mounted on a card and labeled; in addition a specimen of the fruit should be either fastened to the card or skteched upon it.

In this grade the pupils should understand what is meant by a compound leaf which they will find in the hickories, horsechestnuts, and locusts, etc. For the study of a compound leaf note the following: of how many leaflets is it composed; the shape of the leaflets; do the leaflets have petioles; are the edges of the leaflets toothed; which of the leaflets is the largest and which is the smallest; are the leaflets paired and opposite each other; are the leaves opposite each other on the twig or are they alternate?

For supplementary reading use the stories of famous trees.

Leaf and acorn of red oak mounted on a card.
Fourth grade work.

Fifth Grade—The pupils of this grade should be interested in the tree as a whole and perhaps there is no better way to accomplish this than making card mounts which shall include a leaf, a blossom if possible, the fruit, a bit of the bark, a cross-section and a lengthwise section of the wood, and an account written of the tree, where found, for what used, etc. It takes some time to make these mounts and each pupil should contribute one to the school

exhibit and while two may choose the same one it is best to have as wide a representation of tree species as possible. An exhibit of this kind fastened to the walls of the room is of great interest to everybody and of very real educational value.

Another way of securing a wide knowledge of trees is the making of a portfolio of leaf prints which is especially fitted for fifth grade work.

Sixth Grade.—This should include note book work on all the trees in the region. The note books may be those with formal outlines or may be purely individual books with sketches and original observations by the pupils, but in general the note book should include the following observations: 1. Where is it growing, is it planted by man or did it plant itself? If an isolated tree it should be sketched. 2. Does the bole or trunk extend straight up through the head or does it divide into many branches.? 3. The character of the bark of the tree, especially noting whether the bark is smooth, scaly, rolled up, or divided by fissures, and note whether the ridges between the fissures are sharp, rounded, or flattened. Note especially the color of the bark. 4. Are the leaves placed opposite or alternate on the twigs; are the leaves simple or compound? 5. The leaf's appearance above and below. A sketch should be made of the leaf. 6. Describe the time of blossoming and the blossom if possible. 7. Describe and sketch the fruit and tell how it is distributed and planted. 8. In what ways is this tree used by man.

In sixth grade there should be a study of an apple tree and there should be practical demonstrations of grafting and budding, a study of the insects that attack it, and the methods of saving the fruit and the tree by spraying.

Seventh and Eighth Grade.—A study of the larger shrubs, especially those used in planting will interest the pupils of this age. A collection of leaf prints of the shrubs may be made. There should be a special study of park trees and extensive reading and writing in connection with these trees by describing the countries and the geographical distribution in these countries of the trees which we have imported, for instance, the Norway spruce which grows not only in Norway but in the Alps, etc.

A study of the evergreens of the section and the uses to which they are put will prove an interesting line of work.

A prize mount illustrating the red oak, made in a rural school.
Sixth and seventh grade work.

A correlation of trees with history. Select some well grown tree in the neighborhood whose age may be fairly accurately ascertained and relate to it the events in the history of the town and the state. One of the most interesting exhibits ever sent to us from a rural school was a cross section of a small tree which was about fifty years old. A pin was stuck in each ring of year's growth which also held a little label telling of some notable event in the town, the state, or the United States which occurred that special year.

A beginning of forestry may well be made in the eighth grade. There are several elementary books in forestry, notably "The First book of Forestry" by Roth and the "Boy Scout Book of Forestry" by Professor Moon, also access to the American Forestry magazine will open up new and interesting and practical lines of work with trees.

The Birch Tree

Mrs. Addie V. McMullin

Though oak, and elm, and maple tree,
  Call forth our love and care,
With tender buds, and opening leaves,
  They woo the soft May air;
Let not the birch tree be forgot,
  For well I bear in mind
Its spicy buds and fragrant bark,
  I searched the woods to find.

Then plant the birch, the silvery birch,
  Near to the school-house door,
For teachers used its pliant limbs,
  Full oft in days of yore.
And tho 'tis used for rods no more,
  'Twill please the children kind,
Its spicy buds and fragrant bark,
  They search the woods to find.

Leaf print of River Birch.

Leaf Prints

A great stimulus to tree study in fifth, sixth and seventh grades is the making of a portfolio of leaf prints of all the trees in the region. This portfolio may be the property of the school and each pupil contribute a print of special excellence, or what is far better, each pupil may make a portfolio of his own.

The outfit for making leaf prints is simple and inexpensive. It consists of a tube of printer's ink or a cup holding a portion of the ink which almost any newspaper office will contribute to the cause of education. We use an old paste jar for our ink and we bought enough ink to fill it for fifteen cents. Next we must have a

flat, smooth surface on which to spread the ink; a slate, a piece of plate glass, or what we have found more practicable, a large square pie tin serves this purpose. Then we need a six-inch rubber roller such as photographers use for mounting prints and this at a photograph shop costs twenty-five cents; a bottle of kerosene to dilute the ink and a bottle of alcohol or benzine or more kerosene to clean the outfit after using, and we have our outfit ready. Sheets of paper, 8½ by 11, of almost any quality will do although a smooth-surfaced paper is preferable.

The method of operating is thus. With a stick dip out a little of the printer's ink about as large as two peas, upon the pan, add a few drops of kerosene to thin it. Then with the roller work it over until there is a thin film of ink over the smooth surface. This is an important part of the work. The film should not be so liquid as to run but should be a smooth, firm, thin coat. Take a leaf by the petiole, lay it flat on the inked surface, hold it firm with one finger, and pass the ink roller over it several times until the veins are well inked. Lift the leaf by the petiole, lay it on a clean sheet of paper on a smooth table, place another sheet of paper over it, again place the finger firmly on the petiole so the leaf cannot stir and blur the print, and with the fingers of the other hand, press the paper firmly but gently over the leaf, working out the veins and margins carefully. Often a second or even third impression can be made without reinking the leaf and these will be better than the first.

Formerly we used a second clean roller for getting the print by placing the leaf between the sheets of paper, holding it fast by the petiole and rolling it once from base outward with the clean roller, putting plenty of strength into the action. Professor W. W. Gillette of Richmond, Va., who gave us our first lesson in making leaf prints and who taught boys of fourth and fifth grades to make leaf prints which are the best we have ever seen, used a letter press to make the prints, putting in several leaves at a time.

Dried leaves may be soaked in water for a time and spread out and dried between blotters under pressure and be used to make leaf prints while they are still flexible. However, green leaves or autumn leaves as they fall are the best. The hickories and horse-chestnuts and buckeyes, ash and locusts should be gathered first for these compound leaves soon fall apart.

TO MAKE A PORTFOLIO CASE

This is a very neat bit of manual training and if done well will add greatly to the enjoyment of the tree study. Pasteboard, or old book covers, about 9 by 12 may be used. These should have tape pasted on the inside with ends projecting for six inches, then over these pieces of tape should be pasted very thoroughly a lining of strong paper or thin cardboard. The outside of the portfolio may be ornamented with a leaf print or other device pasted on, and the edges of the cover and lining be bound with passe-partout paper Or the two covers may have the back fastened together like the back of a book, allowing an inch and a half for thickness.

The teaching value of the leaf portfolio lies in the accurate labelling of each print. Through doing this the pupil soon comes to know all the trees by their leaves.

A leaf-print portfolio of common shrubs would naturally follow the one on trees; and when the study of botany is begun in first year High, a portfolio of leaf prints of all sorts of plants will be of great help.

"Said the little brown leaf as it hung in the air,
To the little brown leaf below,
'What a summer we've had
To rejoice and be glad,
But to-day there's a feeling of snow.'"

—*Margaret E. Sangster.*

"I find sweet peace in depth of autumn woods,
Where grow the ragged ferns and roughened moss;
The naked, silent trees have taught me this,
The loss of beauty is not always loss."

—*Elizabeth Stoddard.*

Suggestions for Forestry Study in the Eighth Grade or First Year High School

GEORGE H. RUSSELL
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The most important thing to begin with is tree identification. It is necessary to have this knowledge as a background for all forestry study. If the pupils have had a proper training in Nature Study in the earlier grades, they will doubtless know most of the common trees, but the teacher should not take this for granted; but should devote time to a thorough study of the leaves of trees, taking up all available species, even though uncommon in the vicinity. There are various methods of teaching this mode of identification and the particular manner of presenting the work should be fitted to the situation. If the class numbers less than 25 and the trees are not too far away, possibly the best method is to lead the pupils to the trees, letting them collect their own specimens and label them. If this is not feasible, the better way is for the teacher to bring the leaves into the laboratory where they may be drawn and notes made regarding texture, petioles, etc.

The making of card mounts is invaluable in learning about the different species. By taking ordinary cardboard and fastening upon it a leaf, the fruit, together with a piece of the bark, a twig and sections of the wood (X and longitudinal) the collection is made complete.

For each species a brief tabular outline may be made and attached to the mount. The following from Moon's Book of Forestry is a simple example:

BEECH

Fagus Americana.

Bark

Thin, steel gray and very smooth.

Leaves

2½–5 inches long, coarse teeth and with long, slender points.

Fruit

A burr containing 1 or 2 triangular nuts.

Range

Northern New England to Northern Wisconsin. South to Northern Florida and Eastern Texas.

These mounts hung up around the schoolroom are always a source of interest and discussion.

In the winter time the study of bark and twigs may well be taken up. It is a common thing for one to be able to identify by means of leaves, but it is indeed rare that one is found who can identify by the bark and twigs alone. The ideal way, of course, is to study out in the field, though twigs may be brought in if necessary. The coarseness or fineness of twigs is often a simple way, while the fissures of the bark, its smoothness or roughness are usually distinctive. The shape or outline of the bare tree is also a great aid for many species. Estimation of the heights of trees is of value in training the eye to judge distances, and accuracy only comes with experience.

The grains of wood may well be studied in the laboratory in winter. Samples may be obtained from Mr. Romeyn Hough, Lowville, New York.

Pupils at this time should become acquainted with the subject of conservation and come to realize seriously the situation in order that their influence may be used to promote the cause. The Conservation of Natural Resources in the United States, by Van Hise, and published by MacMillan Company, 1917, is an excellent source of information, and there are others as well.

The Uses of Forests—Reduction of Waste in cutting and Milling and Manufacture. Utilization of by-products. Preservative treatment, Substitution of these products for wood are all topics well worth reading. The Book of Forestry by Moon, Chapters 3–5, and Van Hise, Part III, cover this ground. A First Book of Forestry by Roth, Ginn & Co., 1902, is a good book for such reading.

Forest Fire study may also be taken up in the winter through reading and talks. The causes, methods of control, lookouts, and equipment are discussed in many of the books. Van Hise pp. 235–244. Moon, Chap. 8. Roth, pp. 104–112. Gifford, Practical Forestry, p. 150–161.

Forest products, such as Maple Syrup, Maple Sugar, Paper Making, Nut Gathering, etc., are interesting topics and pupils may well choose along their own line of interest and report on their read-

ing. Moon—Book of Forestry, Chap. II. Roth—A First Book of Forestry, pp. 133–182. Gifford—Practical Forestry, Chap. 8.

The methods of reproducing forests should be explained clearly to the pupils, though not in too great detail, but they should learn the various ways in common use and what the terms mean.

Roth, First Book of Forestry, pp. 41–96 is excellent for this work. On the whole this book is probably the most satisfactory for work with pupils of this class. On p. 96 the six principal methods, namely—1. Coppice, 2. Standard Coppice, 3. Selection, 4. Under Seed Trees, 5. Natural seeding from the Side, 6. Artificial seeding or planting, are explained in outline form.

In the spring months a study of some nearby woods should be made in some detail. The kinds of mature trees and approximate percentages of each species, the saplings and the undergrowth should be carefully noted. A study of the forest floor is profitable. The finding of the layers of leaves, humus, heavy soil and rocks and stones may be made interesting. The work should be individual and reports should be checked over. In these months the buds of trees may be studied and this method of identification developed.

In this study the material is limitless very often, and if a woods is nearby, ample opportunity is offered for much enjoyable work with these staunch and sturdy friends of man, but I have only attempted to name a few of the topics which might prove useful in teaching this work.

"One mass of sunshine glows the beach;
Great oaks, in scarlet drapery, reach
Across the crimson blackberry vine,
Toward purple ash and sombre pine.

The orange-tinted sassafras
With quaintest foliage strews the grass;
Witch-hazel shakes her gold curls out,
Mid the red maple's flying rout."

—*Lucy Larcom.*

The Teaching of Plant Diseases in the Grades

William Gould Vinal

Given in the Seminar, Botany Department of Brown University

As the history of parallel movements may throw light upon our present problem it may be worth while, as well as interesting, to briefly review old acquaintances.

In searching the mouldy rolls of the past one finds that the fruit of that forbidden tree furnish a frequent theme. As early as 1340 in the "Ayenbite of Inwyt," the title of a religious treatise by a monk, appears the well known saying that "a roted eppel amang the holen, maketh rotie the yzounde." Shakespeare in the Merchant of Venice (Vl. iii, 102) mentions "a goodly apple rotten at the heart" and in the Taming of the Shrew (I. i. 139) says: "Faith (as you say) there's small choice in rotten apples." As these are suggestive of the manner of mentioning plant diseases in the past one must conclude that the purpose was not so much to teach the disease of the plant as to teach human morals.

The handing down of knowledge of moulds, blight, and rust has been in the folk-lore stage and is so today in most cases. The crediting of the failure of a crop to an east wind or some such force is the method of the Australian native. The medicine lore of the savage is but just disappearing along the fence row of the farmer and remains with the untutored, yet a scientific knowledge of these things is a practical necessity for a civilized community.

One might expect that the history of the hygiene movement in the grades would be suggestive as to the possibilities in garden hygiene but such is not the case. A little research shows that we are only in the initial stages of teaching the child how to care for himself. "In 1900 only eight cities in American had any organized health work in schools" (U. S. Bureau of Education Bulletin, 1913). The Greeks emphasized physical training and Locke and Rousseau preached it, but clean hands as a prevention of disease was unheard of at that time. It was not until 1885 that physiology and hygiene were made a compulsory study by the laws of Massachusetts, and that was one of the first states to make the subject a part of the curriculum. When human hygiene is so recent that it scarcely has a history it would not seem over encouraging for the study of plant diseases.

We do not need to be reminded that the teaching of plant diseases in any organized way is very recent. The Yearbook of the Department of Agriculture for 1899 tells us that in 1885 there were only three institutions teaching this subject and that ten years later "50 colleges and stations engaged in the work and at least 100 special investigators were devoting their time to it."

Notwithstanding these preliminary remarks there are sufficient reasons for introducing the subject at this time. In Massachusetts alone for the summer of 1918 it is reported that 75,000 boys and girls not living on farms had gardens. If they are to be encouraged in this work they must know how to take care of these diseases which are so prevalent. Then, again, the potato blight is not a concern of Maine alone nor the black wart of the potato, in Pennsylvania, just a question of that state. There must be a Federal intelligence in regard to the things which concern its welfare. Likewise, a healthy garden is a community asset, and the ignorance of one gardener is a menace to the whole neighborhood. Other by-products of this knowledge will be a greater intelligence in regard to the causes of all diseases and their cure by patent medicines. Then, the consumer should have an appreciation of wholesome food and knowledge as to how it should be cared for in the home. He should have some notion as to what it costs to grow clean healthy produce and a greater respect for the farmer. A far more important result may be the plant physician for every community. He will work after the fashion of the Chinese doctors who are paid for the prevention rather than the cure of diseases. In this way the working power of the gardens of the community will be kept at top-notch efficiency.

If plant diseases should be taught in the grades what are some of the topics that may be presented and what method ought to be used? The following notes are merely suggestive as to a few projects.

Cut slices of raw potato with a sterilized knife and place each slice in a saucer under a glsss. Place under different conditions, such as: warm, cold; dry, moist; sunny, dark; a slice that has been in contact with a dusty surface and one that has not; peeled and unpeeled; a healthy potato in contact with a decaying spot on another potato, and a healthy potato in contact with a healthy potato; a bruised and a scratched potato and a sound potato. A child can easily derive the following practical conclusions by

observing the color changes and decay effects without the use of a microscope: Vegerables and fruits decay more readily in dark, moist, warm cellars. Unclean receptacles aid decay. The skin keeps out germs of decay. Decay is passed on by contact. Fruit should be handled carefully. Coldness, dryness, and sunshine are germ killers.

Another series of experiments is with dishes of agar. Make finger prints before and after washing the hands. Expose a dish for five minutes before and for five minutes after sweeping; before and after a thunder shower; early in the morning and late in the afternoon; a drop of distilled water, faucet water, and dish water. Try inoculation experiments with a sterile needle, as—removing bits of decaying potatoes, oranges, onions, apples, parsnips, etc., to a test tube with agar and stopping mouth of tube with absorbent cotton. Inoculation now becomes a visible thing to the child.

Visit a diseased potato field. Where is the disease thriving most,—in the rich or poor soil, at the low moist end of the garden or where it is well drained, where the foliage is crowded or where plants are far apart, on the sunny corner or the shady corner? Are there any varieties that appear to be more susceptible? The class will be impressed with the fact that the lack of proper food, overcrowding, and absence of sunshine lowers the vitality of the plants and makes them susceptible to disease. These conclusions must make the conditions of human hygiene seem real and not a matter of preaching.

A field trip to a woodlot is also of great value. Find trees being destroyed by fungi. What enabled the fungi to attack the tree? See how many kinds can be collected. Find leaves with blemishes and colored spots which are symptoms of disease. Symptoms in plant diseases are much more evident than with people.

A lesson on the higher parasites such as dodder, mistletoe, etc., may be made a basis of morals. The law of the use and disuse of parts is rather striking in these plants.

A lesson in history will also be instructive such as a report on the cause and effect of the potato blight in Ireland during the great famine of 1844.

Have an exhibition of moulds brought in from the homes. Include everything,—shoes, books, fruits, preserves, etc. In class discussion bring out the causes and emphasize the preventions. Try to get an estimate as to how much is destroyed each year by moulds in the home.

Some people may feel that a knowledge of these things leads to unhappiness. It reminds me of a story that I read a long time ago about an Arab who admonished a traveller for having stepped on a worm. The traveller asked the Arab if the did not know that he was destroying hundreds of living beings when he ate a fig. When the dusky inhabitant of the desert was shown the organisms through a microscope he took the microscope and dashed it against a rock. Let us not accept the philosophy that 'ignorance is bliss'.

Trees the Oldest Living Beings

When one stops to consider the length of life of trees one cannot help being impressed. When we stood in admiration before the giant Sequoias, the awe they inspired came from the thought that these were vigorous young trees two thousand years ago and that they still put forth their leaves and shed their cones every year. There are cedars now on Mt. Lebanon that looked forth over Palestine when Christ was teaching there, and they lived on to see the glory of Rome fade and the teachings and commands of the humble carpenter received by millions over an earth undreamed of by Him.

Perhaps the oldest of living trees is one in Mexico, a bald cypress east of Oaxaca. In 1803 Humbolt visited this tree which is held in great veneration by the natives. In 1903 Dr. Hermann Von Schrenk made a pilgrimage to this venerable cypress and found it measured breast high 126 feet in circumference and he estimates that its age is perhaps 4000 years. It was probably a well-grown tree when Rameses II was building the temples at Luxon and Karnak—and waged his battles with the Hittites. If it could talk so that we might understand what a story it might tell.

The Birches

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"Birch" by some is derived from Bety its Celtic name; by others from the Latin, batuere, to beat, because the fasces of the Roman lictors, which were always made of birch rods, were used to drive back the people.

The Birches are a family of exceedingly graceful and attractive trees, and charm quite as much in winter by the color of their stems and the delicacy of their twigs, as they do in summer by the fresh green of their foliage. They vary in appearance according to the places where they grow. If shaded by other trees in the woods, their trunks are tapering, tall and free from branches; but when they grow in open fields and the lateral branches develop, their general outline is bushy and far less attractive; but unlike other trees, birches are improved by not having full development. The birch has been known from the earliest ages and is found in Europe, Asia and North America.

The Birches have distinguishing characteristics in the details of buds, leaves, stems and texture of the bark of trunk and branches. The buds form early and are full grown by midsummer, all are lateral; no terminal bud is formed. The wood of all the species is close-grained with satiny texture and capable of taking a fine polish.

The leaves of the different species vary but little. All are alternate doubly serrate, feather-veined, petiolate, and stipulate. Apparently they often appear in pairs but these pairs are really borne on spur-like, two-leaved lateral branches. The flowers are monoecious, opening with or before the leaves and are borne in three-flowered clusters in the axils of the scales of drooping or erect aments. Staminate aments are pendulous, clustered or solitary in the axils of the last leaves of the branch of the year or near the ends of the short lateral branches of the year. They form in early autumn and remain rigid during the winter. The scales of the staminate aments when mature are broadly ovate, rounded, yellow or orange color below the middle and dark chestnut brown at apex. Each scale bears two bractlets and three

sterile flowers, each flower consisting of a sessile, membranaceous usually two-lobbed, calyx. Each calyx bears four short filaments with one-celled anthers or strictly, two filaments divided into two branches each bearing a half anther. Anther cells open longitudinally. The pistillate aments are erect or pendulous, solitary, terminal or the two-leaved lateral spur-like branchlets of the year. The pistillate scales are oblong, ovate, three-lobed, pale yellow green often tinged with red, becoming brown at maturity. These scales bear two or three sterile flowers, each flower consisting of a naked ovary. The ovary is compressed, two-celled, crowned with two slender styles; the ovule is solitary.

The ripened pistillate ament is called a *strobile*, and bears tiny winged nuts, packed in the protecting curve of each brown and woody scale. These nuts are pale chestnut brown, compressed, crowned by the persistent stigmas. The seed fills the cavity of the nut.

Michaux arranged the birches into two groups, one including trees whose pistillate aments are sessile and erect: the Black, the Yellow and the Red; the other, those whose pistillate aments are stalked and pendulous; the Canoe, the White and the European White Birch. We will first make a study of those whose pistillate aments are sessile and erect:

The Black, Sweet or Cherry Birch is found from New Foundland to Western Ontario; south to Florida, Kentucky, Tennessee and Kansas. It is a handsome, round headed tree, fifty to eighty feet high, symmetrical with slender, often tortuous but graceful limbs, the lower ones drooping, and with delicate polished twigs. The bark is dark brown broken by furrows into thick, irregular plates which show fragments of the smooth, silky, bark that covers young limbs. The smooth outer layer, with its prominent horizontal lenticels, reminds one of the bark of cherry trees. This epidermis finally disappears from the large trunks, but it may always be found covering the limbs. It is one of the handsomest trees of the woods. In winter the grace of the pendulous branches and the symmetry of the round head are best revealed. "On the bark," says Annie Oakes Huntington, "from dark brown trunk to golden-brown twig, a satiny sheen gives brilliancy and depth to colors. The tree seems aglow with life even in its winter sleep, and the plump buds and the impatient catkins, already nearly an inch long, promise what the spring fulfils. The abundant sap

which mounts upward in early April forces out the catkins into tassels that hang all purplish yellow, and very large, from near ends of the branches. Erect among them are the green pistillate ones, rising on the ends of short side shoots. The abundance of its leaves and their glossy sheen and brightness set this birch apart from others in mid-summer. In autumn they turn gold."

As one author says, "when we go among the trees and perhaps rest for awhile under the shade of the sweet birch, we might, if our ears were sufficiently quickened, hear many tales of country lore that are passing through the swish of its leaves. Tales are astir about the evil spirits that seek it and greedily devour its sweet bark. The tree could also tell of many that love the shimmer of its leaves; that notice the golden pollen in its beautiful spray of staminate blossoms and partake of its shade as graciously as tho they were accepting a gift from a friend."

I think when we were children and probably now as then we identify this tree by the delicious taste of its twigs. An oil similar to wintergreen being extracted from the bark and foliage is an important article of commerce. It is used medicinally and as a flavoring extract.

In Kamchatka the natives strip the inner bark into long shreds like vermicelli. This is done in spring when it is richest in starch and sugar. These strips are dried for winter use as food. They are boiled with caviar and with fish. Birch beer is made by fermenting the sweet sap.

The sweet birch knows the stroke of the axman, for its fine dark reddish wood is valuable. It is strong and heavy and receives a beautiful polish.

The Yellow or Gray Birch prefers the rich moist uplands and is distributed from Newfoundland south to Delaware, North Carolina and Texas west to Minnesota. It is a beautiful, straight tree, fifty to ninety feet high, distinguished from the black birch by its yellowish or silver-grey bark, which, unlike the brown bark of the black birch rolls back and peels off in thin, filmy strips from the trunk. The bud scales overlap each other, and the leaf scars are alternate. Its delicate twigs have an aromatic taste but not as sweet as the black birch. The catkins are larger around than those of the black birch.

This is in every way a worthy sister tree of the black birch, and the rich yellow of the trunk, but partially revealed through the

gray, shaggy outer layers of the bark, is quite as beautiful as the rich red-browns of the black birch bark. Thoreau felt the charm of the yellow birches and in his journal of Jan. 4, 1853, he says: "To what I will call yellow Birch Swamp, E. Hubbard's in the north part of the town,—west of the Hunt's pasture. There are more of these trees in it than anywhere else in the town that I know. How pleasing to stand near a new or rare tree; and few are so handsome as this; singularly allied to the black birch in its sweet checkerberry scent and its form, and to the canoe birch in its peeling or fringed and tasselled bark. The top is brush-like, as in the black birch. The bark an exquisite, delicate gold color, curled off partly from the trunk with vertical clear or smooth spaces, as if a plane had been passed up the tree. The sight of these trees affects me more than California gold. I measured one five and two-twelfths feet in circumference at six feet from the ground. We have the silver and the golden birch. This is like a fair-flaxen haired sister of the dark complexioned black birch, with golden ringlets. How lustily it takes hold of the swampy soil and braces itself. In the twilight I went through the swamps, and the yellow birches sent forth a yellow gleam which each time made my heart beat faster. Sometimes I was in doubt about a birch whose vest was buttoned, smooth and dark till I came nearer and saw the yellow gleaming through, or where a button was off."

The yellow birch is one ot the most valuable timber trees of the North. The wood is heavy, hard and strong, and is used for making furniture, the hubs of wheels, and boxes. Few hard woods of light color make as attractive flooring as polished yellow birch.

The Red Birch is easily distinguished from all the other birches by its reddish, loosely peeling bark, which gives the trunk an unkempt shaggy and torn appearance. It should not be inferred from this description that the red birch is lacking in beauty, for it is a most attractive tree. Its general outline is picturesque, and the soft red color of the peeling epidermis of the bark in the upper branches has a very pleasing effect. The red birch is the only semi-aquatic species among the birches, and its drooping branches hanging over the water add much to the beauty of our streams and rivers.

Annie Oakes Huntington gives us an excellent description of the red birch. It is a medium sized tree found on the edges of streams. It has long, graceful sweeping upper limbs, with small, pendulous lower branches. The bark is reddish, very shaggy and loose,

flaking off and rolling back in thin strips. The twigs are reddish brown and pliant, and the leaf scars are alternate.

Its wood is light and strong and is used for furniture, wooden ware, ox yokes, shoe lasts and shoes. The red birch is found growing on the banks of the Nashua and Merrimac Rivers and beside smaller streams in Massachusetts, but it grows more frequently along river banks in the South than in the North.

Now we will make a study of those birches whose pistillate aments are stalked and pendulous; the Canoe, the American White and the European White.

The Canoe Birch, which is perhaps one of the best known birches and about which a great many poems have been written, is found from Labrador to the Alaskan Coast; south to Long Island, northern Pennsylvania, Central Michigan and Minnesota and through the northern west. (However it is at its best along the bayous of the lower Mississippi, where its roots and base of trunk are inundated for half the year). The canoe birch reaches a higher latitude than any other deciduous tree, and covers a wider territory.

The bark which gives name and character to the tree, is distinguishable from the white bark of other species by its pearly surface and chalky whiteness. which rubs off on clothing. It strips readily into thin horizontal sheets, marked with elongated lenticels or breathing holes. The pearly lustre of its clean white bark and the density of its lustrous foliage make it one of the most beautiful, as it is one of the largest, of our native birches.

The fruit ripens in June and the wind, shaking the erect cones, scatters the seeds on the rich land from which the water has subsided. Here they germinate at once, and are rooted, vigorous little seedlings by the time the floods return, able to keep their heads above water and to thrive like their parents, adding color and grace of line and motion to the landscapes of many different regions.

Alice Lounsberry gives a beautiful description of this tree and its uses; "Happily the canoe birch wears a uniform that we all know and when many of the trees are seen from afar, amid the dark shades of the forest, they appear not unlike the advancing guard of a regiment. The tree seems to belong especially to the primitive people of the north, who must surely regard it with affection. The Indian's canoe carries him swiftly and silently, guided by a

paddle made of the same tree. When the streams are frozen and snow covers the earth, he is drawn on sledges or glides along on snow-shoes that are constructed from this tree. The Indian's wigwam is protected by its resinous bark, and when sweet sap begins to flow in the springtime he knows how to boil it into syrup or make it into a cooling drink. Of his life the tree is a part, and from the standpoint of sentiment it seems as though it should be left for the Indian rather than given to the lumber men who sell it for making shoe lasts, pegs and fuel."

No other tree has a bark so shiningly white, and even the snow is unable to dim its purity. We usually think of the tree as being fragile and delicate, especially as we recall it as it grows along the edge of woodlands where the shade of other trees has forced it to grow slender and tall in reaching for light.

Longfellow tells us that "The great triumph of the birch is the bark canoe. The design of a savage, yet it looks like the thought of a poet and its grace and fitness haunt the imagination. He says that he supposes its production was the inevitable result of the Indian's wants and surroundings, but that does not detract from its beauty. "It is, indeed, one of the fairest flowers the thorny plant of necessity ever bore."

John Burroughs tells us that curious traditions gather about this natural paper. That Pliny and Plutarch agree that the famous books of Numa Pompilius, written seven hundred years before Christ, were of birch bark, and the Sibylline leaves purchased by Tarquin are by some believed to have been of the same material.

It is a shame, I think, the way some of these trees are damaged by tourists. The inner bark contains starch so abundantly that it is a valuable resource to the people of the extreme north who bruise and mix it with their foods.

In Longfellow's Story of Hiawatha we find again the usefulness of the birch.

"Give me of your bark, O birch tree!
Of your yellow bark, O birch tree!
Growing by the rushing river,
Tall and stately in the valley!
I a light canoe will build me,
Build a swift Cheemaun for sailing,
Thou shalt float upon the river,
Like a yellow leaf in autumn,
Like a yellow water lily!
"Lay aside your cloak, O birch tree!

Lay aside your white-skin wrapper,
For the summer time is coming,
And the sun is warm in heaven,
And you need no white-skin wrapper!"
Thus aloud cried Hiawatha
In the solitary forest.

A birch which is sometimes confused, at first sight, with the canoe birch is the American White. But at a second look you will notice the white birch has a close-fitting bark which is a dirty white in color, with triangular black blotches under the branches, it is exceedingly chalky to the touch and never peels off in thin lateral strips, is clear white in color and seldom shows any dark blotches on the trunk. The bark of the recent shoots of the white birch is rough to the touch, and that of the canoe birch is smooth and sticky where the buds join the stem. Its wood is soft, light and neither strong nor durable. The specific name, *populifolia* (poplar-leaved), refers to the leaves which quiver in the wind and show light under surfaces like the aspens. Through it a stream of tenderness seems to flow, for its trunk too is flexible, and often during the winter bends under the load of ice it has to uphold. Its powers of endurance are greatly in contrast to those of many of the trees, the oaks especially.

This little birch, we are told, is perhaps the least interesting member of a most attractive family. It is found commonly growing along the sandy banks of country roads and in waste, barren places where pitch pine and blueberry bushes and scrub oaks are found. It is invariably associated with sterility in our minds, and seems to demand nothing of the soil on which it grows adapting itself immediately to its surroundings and thriving where other trees would die. In southern New England it is frequently found growing in the margins of swamps.

Commercially, it is not of any very great value except perhaps for wood pulp. Its soft, weak wood is too perishable. Wheel spokes and barrel hoops are made from it, and upon the hearth it finds a welcome place.

And now we come to the birch which is extensively cultivated in this country but is a native of Europe. This is the European White Birch and is found adorning many of our parks and gardens. It has a white chalky bark, long, slender, down-sweeping branches, small buds and alternate leaf scars. The only fault with this birch

is that it is very short-lived and as Clarence M. Weed says, is "Like a Lady in a far country".

I found some very vivid descriptions of this tree: The slender, drooping branches are so long and pliant that the slightest breeze sets swaying in one direction from the trunk, like a shower of rain driven by the wind. The birch does nor lose its pendulous grace in mere limp dejection, like most of the weeping varieties of trees that gardeners love to propagate, but it holds its head high and the slender branches droop down,—a striking contrast to the weeping willow and other lachrymose specimens of horticultural art.

There have been constant allusions to this tree in English literature. Perhaps the most descriptive is one of Sir Walter Scott's which refers to the slender, pendulous boughs,

> "Where weeps the birch with silver bark
> And long dishevelled hair."

From an artist's point of view much has been said about these trees. In the "Sylvan Year," Philip Gilbert Hamerton calls the stem of the birch "one of the masterpieces of Nature," "Everything," he says "has been done to heighten its unrivalled brilliance. The horizontal peeling of the bark, making dark rings at irregular distances, the brown spots, the dark color of the small twigs, the rough texture near the ground, and the exquisite silky smoothness of the tight white bands above, offer exactly that variety of contrast which makes us feel a rare quality like that smooth whiteness as strong lays we are capable of feeling it. And amongst the common effects to be seen in all northern countries, one of the most brilliant is the opposition of birch trunks in sunshine against the deep blue or purple of a mountain distance in shadow."

Miss Jeckyll, in "Wood and Garden", says that the tints of the stem give a precious lesson in color. "The white of the bark", she says, "is here silvery white and there milk white, and sometimes shows the faintest tinge of rosy flush. Where the bark has not yet peeled off, the stem is clouded and banded with delicate gray and with the silver green of lichen. For about two feet upward from the ground, in the case of young trees of about seven to nine inches in diameter, the bark is dark in color, and lies in thick and extremely rugged and upright ridges, contrasting

strongly with the smooth white skin above. Where the two join, the smooth bark is parted in upright slashes, through which the dark rough bark seems to swell up, reminding one forcibly of some of the old fifteenth century German costumes, where a dark velvet is arranged to rise in crumpled folds through slashings in white satin."

The wood is used in Europe for fuel and making furniture. It is rather curious to find that the birch has been celebrated as an instrument of chastisement since early Roman times.

Gerard says that in his time "schoolmasters and parents do terrify their children with rods made of birch"; and Shenstone, in the "Schoolmistress", has a pathetic little account of the fears of small boys as they watched the wind waving the branches of a birch tree growing by the schoolhouse,

> "For not a wind might curl the leaves that blew,
> But their limbs shuddered, and their pulse beat low,
> And, as they looked, they found their terror grew,
> And shaped it into rods and tingled at the view."

In northern Europe, the birch is principally used for fuel. Russians eat with wooden spoons and wear wooden shoes, both made of birch. They live in houses furnished with birch furniture and shingled with slabs of birch bark. They strip and grind the soft inner bark, and mix it with meal in their bread. Birds feed upon its seeds in winter. Lopped trees send up suckers which are cut and bound into birch brooms. Birch mead and wine are most refreshing beverages. The birch bark yields tannin, a yellow dye, and an oil which gives Russian leather its characteristic color and odor. Swedish farmers look for the opening leaves of the birch as a sign to sow their barley. In Parkinson's day the "physical uses" of birch were few. But he adds:

"Many other civill uses the Birch is put into, as first to decke up Houses and arbours, both for the fresh greenesse and good sent it casteth; it serveth to make hoopes to bind caskes withall; the young branches being fresh are withered, and serve for bands unto faggots; of the young twigs are made broomes to sweepe our houses as also rods to correct children at schoole, or at home, and was an ensigne borne in bundles by the hictors or Sargeants before the Consulls in the old Romans times, with which, and with axes borne in the like manner, they declared the punishment for lesser, and greater offenses, to their people."

In the very end of their swift decay birch trees served the fashionable world in the heydey of the powdered wig. "The whitest part of the old wood of doating birches is made the grounds of our effeminate farined Gallants' sweet powder."

American birches are more valuable lumber trees and more graceful for ornamental uses than the forest birches of Europe.

The European birch is found throughout the north of Europe, and grows in every kind of soil, both wet and dry. The Earl of Haddington called it, with quaint humor, "an amphibious plant", and after two hundred years this is still descriptive of its habits.

Mathews tells us that there is an extreme species of birch in our country, a shrub rather than a tree, which shows how nature sometimes deviates from her commonest types. *B. glandulosa* is a dwarf variety of the birch, with miniature leaves and stunted stems, which is found among the high mountains of New England. It grows close to the ground, hugging rocky foundations, and the smooth, brown branches are conspicuously dotted with resinous, wartlike glands. The bush grows from one to four feet high and the leaf is scarcely over three-quarters of an inch long.

President Eliot once said that he had often reflected on the problem of why one person is a successful teacher, while another of equal knowledge, talent and character fails. As the result of much observation he had concluded that what makes a teacher successful is the power to impart joy. The end of a teachers work should be to inspire in the pupil joy in learning, joy in the possession of truth. This is not a lower aim than some other conceivable one, but the highest of all, for joy is the highest end of the universe, the final purpose of God himself.—*Frank C. Porter.*

Bird Song

Entre nous,
Je suis heureux,
Et plus, que voulez nous ?

T. D. A. Cockerell.

Putting "Pep" into the Field Trip

C. C. Leeson
State Teachers' College, Maryville, Mo.

The hour of 6:30 a. m. finds us on our way to the woods and ravine on a tree study trip. Our luggage consists mainly of a breakfast menu of bread, butter, bacon, cookies, oranges, gum and a water bucket. Along the highway we walk in two's, changing partners every five minutes with a different nature topic at each change for conversation.

We pass thru a small cemetery and, while resting on the tombstones, each writes the epitaph that is to appear on his grave.

"Here lies a college man
Gone on before
Meet me if you can
On the bright and golden shore."

"Here I lay my burden down
Change the cross into a crown
I hope some day you'll follow me
Into the land of jubilee."

A short journey brings to our breakfast time which is reached only after observing the stipulated number of 20 tree varieties. Each person is given a match and required to build a small fire. Failure to do so will be penalized by having to gather sticks for the successful builders.

A guessing box is called for with each one contrinuting a conundrum on some tree or phase of tree life. A few of those propounded follow:

What do you do when worn by sorrow?—Pine.
A small bed on the floor.—Cot-on-wood.
A farm tool for sowing grain.—Cedar.
The call of a mule and a brier.—Hawthorne.
What you say when you set the dog on.—Sycamore.
What a freshman always is.—Evergreen.
A word meaning well-liked" less its middle letter.—Pop-lar.
Second personal pronoun.—Yew.
What is left after the fire.—Ash.
The edge of a lake.—Beech.

A collecting contest follows, each bringing a sample from as many varieties of trees as possible within a limited time. The winner is honored by a toast from each of the others, or perhaps is given a stick of gum for a prize.

We wonder about the human side of trees and think of the oak as symbolical of rugged strength, the pine stands for endurance and patience, the willow for mourning, the sycamore as battle scarred warrior, the lombardy poplar for upright character, the black locust as a wanderer, the maple for gracefulness. We recall that the Bible refers to the "tree of life" thirty-eight times, and likens the righteous man to the tree. We think of the voices of nature and note the whispering pines, the moaning tree tops, the whistling wind, the babbling brook, the sweet cadence of bird note, the rustling leaves, the creaking branches, the night stillness, and recall that the Bible refers to the trees as clapping their hands.

We write nature poems with much merriment and some poetic skill.

"Oh the sounds that reached my ears
On that morning bright and clear.
There were sounds of birds galore
Songs of dozens, yes, and more."

"A great success was our trip that day
Studying trees and birds by the way
Over the hills and thru the ravine
The jolliest bunch that ever was seen."

A member of the class reads Bryant's Forest Hymn which is is appreciated as no where else out in the real forest that inspired its writing. We count up our tree list and find to our credit 35 varieties which we have tried to note by the identifying features of bark, bud, leaf, fruit.

We return to school in time for the ten o'clock classes singing the college songs on the way and feeling that here had been one profitable and jolly field trip.

THE NATURE-STUDY REVIEW

DEVOTED PRIMARILY TO ALL SCIENTIFIC STUDIES OF NATURE IN ELEMENTARY SCHOOLS

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Editorial

Trees and Folks

"A tree whose hungry mouth is pressed
Against the Earth's sweet flowing breast,
A tree that looks at God all day
And lifts her leafy arms to pray."

Thus sang Joyce Kilmer in his most famous poem, and voiced the first task of the Nature-study teacher, which is to make the child know and feel that a tree is a living being in many ways like to himself. The poets often have the true nature-study point of view, especially so in dealing with trees; they have realized and expressed not only the relationship of trees and themselves to life but have sung touchingly of the human sense of brotherhood with trees and of tree personality of which the true nature lover is always conscious. Lowell says:

I care not how men trace their ancestry
To ape or Adam; let them please their whim;
But I in June am midway to believe
A tree among my far progenitors, .
Such sympathy is mine with all the race,
Such nutual recognition vaguely sweet
There is between us.

Bryant expresses the sentiment thus:

"Trees of the forest, and the open field!
Have ye no sense of being? Does the air
The pure air, which I breathe with gladness, pass
In gushes o'er your delicate lungs, your leaves,
All unenjoyed? Wnen on your winter's sleep
The sun shines warm, have ye no dreams of spring?

* * * *

Nay, doubt we not that under the rough rind,
In the green veins of these fair growths of earth,
There dwells a nature that receives delight
From all the gentle processes of life,
And shrinks from loss of being. Dim and faint
May be the sense of pleasure and of pain,
As in our dreams; but, haply, real still."

Bayard Taylor believed he inherited his poet's soul from an ancestral pine tree for he says

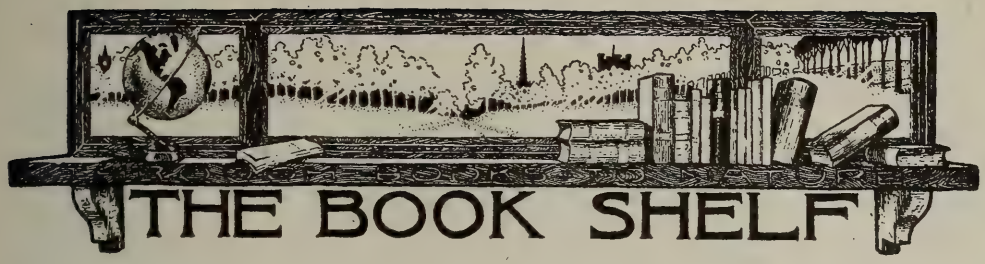
"All outward wisdom yields to that within,
Whereof nor creed nor canon holds the key
We only feel that we have been, and evermore shall be.
And thus I know, by memories unfurled
In rarer moods, and many a nameless sign,
That once, in Time, and somewhere in the world
I was a towering Pine.

Thence am I made a poet: thence are sprung
Those motions of the soul, that sometimes reach
Beyond the grasp of art, for which the tongue
Is ignorant of speech
And if some wild, full gathered harmony
Roll its unbroken music through my line,
There lives and murmurs, faintly though it be,
The Spirit of the Pine."

It remained for Lanier the most sensitive of our Nature poets to express the nearer relation of the tree to his soul

"Tell me, sweet burly-bark's, man-bodied Tree
That mine arms in the dark are embracing, dost know
From what fount are these tears at thy feet which flow?
They rise not from reason, but deeper inconsequent deeps,
Reason's not one that weeps.
What logic of greeting lies
Betwixt dear over-beautiful trees and the rain of the eyes?"

Although the mass of human kind have by no means reached to the heights of the poets in relation to trees and although we still lay waste our forest lands, yet there is undoubtedly a growing sense of the value of trees and a feeling for them abroad in America. Some years since, it became necessary because of changes in plan of roads to cut down some elms on the Cornell Campus; the laborers did this work in the early morning to avoid the indignation of the students passing on their way to class-rooms. This was rather hard on the laborers but we regarded it as a sign of a trend of sentiment in the right direction.



Bird Behavior, Psychical and Physiological, by Frank Finn, F.Z.S., 363 pages, 43 illustrations, Dodd, Meade & Co.

This is one of the most remarkable books on birds published recently. It is written by a man who has had a long experience in observing birds in their natural surroundings in many countries for he is an Englishman and was stationed in India for years; he has also had a wide experience in zoological gardens in observing birds in captivity and under domestication. He is thus exceptionally well fitted for the task of describing bird behavior and discussing the relationship of structure to habit. The following general topics are discussed: Locomotion, Nutrition, Propagation, Migration, the Senses, the Emotions, the Weapons and Fighting Methods, the Songs and Cries, the Special Instincts, the Special Physiological Peculiarities and the Abnormalities of Bords, and one chapter is given to the Relation of Birds with Man. While these may seem to be live topics for chapters yet they scarcely convey an adequate idea of the interesting phases of bird life which they are made to cover in this volume. For instance, under the Special Instincts of Birds are discussed—the Play of Young Birds and of Adults, Bower Builders and their Peculiarities, Ornamentation of Nests, the Instinct for Food Storage, The Practice of Piracy, Toilet and Bedtime Habits. After all, the great value of the book comes from the fact that it is based upon personal observation. It is a volume that should be in every bird lover's library and it is of special value to the biologist.

Insect Artizans and Their Work. Edward Step, F.L.S. 318 pp., illustrated. Dodd, Meade & Co.

Any one who studies the habits of insects must become impressed by the skill which they show in making their nests and in various other of their interesting activities. This volume by Dr. Step discusses seriously and with careful regard to facts the different phases of Insect Artizanship. The chapter on "Spinners and Weavers" tells of the spinning of caterpillars, of moths and butterflies; that on "Miners", of the bees, wasps, beetles, crickets, and the other insect mine diggers; that on "Masons", deals with wasps, bees, and white ants. "Carpenters and wood-workers" tells of bees, the larvae of beetles moths. "The Upholsterers" are solitary bees including the leaf cutter bees. "The Waxworkers" are the bumble bees and honey bees. "Paper Makers" are the wasps. "Tailors" include bag-worms, caddis-worms, clothes moths and others. The Horticulturists are ants and termintes. The "Sanitary Officers" are the various flies and beetles that feed upon decaying matter. The "Musicians" are the Cicades, grasshoppers, katydids and crickets. The lamp-bearers are the various "fireflies". The "Burglars" among insects are apparently also artizans for they show skill in obtaining what belongs to others to

use for themselves. There are many species of these that rob the bees and wasps of their hard-earned possessions. This is a volume for the general reader for it is full of interesting information, at the same time it is a valuable book of reference in the library of the biologist. It contains 39 fine illustrations from photographs. While the books deals largely with English species yet it discusses very many American species as well as those from other countries.

Common Science. Carleton W. Washburne, Superintendent of Schools, Winnetka, Ill. 390 pages, illustrated by photographs, World Book Co., New World Science Series, edited by John W. Ritchie.

Fifty years ago Physics as taught in Seminaries and Colleges had to do with the phenomena of every day life and was a most attractive study. Later the advanced physics as taught in the Universities dribbled down to the High Schools and too often made the subject difficult and unattractive. The introduction of the Junior Science work in the schools was looked upon askance at first for fear that here again we should have grown up subjects compressed into capsules fit for children's throats so that they might be stuffed with more things. Happily teachers who have an understanding of the child mind have come to the rescue and this Common Science volume is as encouraging as it is pleasing for it deals simply and most interestingly with the common phenomena of a child's environment. The book begins with "Gravitation" which we all experience but of which we know so little; it suggests that we play that we fit up a cabin with all comforts and move out into space 160,000 miles to the spot where the sun's gravity would just balance the earth's gravity and where therefore there would be no gravity. Here, "when you try to walk you glide toward the ceiling. If you push on the ceiling, you float back toward the floor." "There is no up or down—you discover this quickly enough when you try to pour a glass of water. No matter how you hold the pitcher and glass the water will not pour. Finally you have to put your hand into the pitcher and pull the water out. It comes. Not a drop runs between your fingers—which way can it run since there is no down? The big lump of water stays right in your hand. This surprises you so much you let go of the pitcher. Never mind; the pitcher stays poised in mid air," and thus on for two pages of delightful imagining, that probably for the first time will show the child what gravity means to those living on the surface of the earth. The topics dealt with are Gravitation, Molecular Attraction, Conservation of Energy, Heat, Radiant Heat and Light, Sound, Magnetism, Electricity, Mingling of Molecules, Chemical Change and Energy, Solution and Chemical Action, Analysis. What a list of grown up topics! However, each chapter resolves itself into explanations of things which every child sees and notices. For instance in the Inference Exercise in Molecular Attraction is "Explain the following: When you wet your finger you can turn a page more easily; a lamp wick draws oil up from the lower part of the lamp to the burner; when your hands are cold you rub them together to warm them." Under electricity the following are a few of the topics discussed: "Why do you get a shock if your hands are wet when you touch a live wire? Why does a door-bell ring when you push a button? Why can a bird sit on a live wire without getting

a shock, while a man would get a shock if he reached up and took hold of the same wire? What makes an electric heater hot? Why does lightning kill people? Under Chemical Change and Energy such topics are discussed as: "How gasoline makes a motorcycle go and why it goes 'pop, pop, pop'; What makes a gun shoot? Why a fire is hot? What flames are? What smoke is? How a camera can take a picture? What makes cloth fade in the sun? What makes freckles?"

The book is charmingly illustreated with photographs of real boys and girls performing the experiments and in the reviewer's opinion will prove an important factor in making the book attractive to Junior Scientists. A pamphlet accompanies the book giving the teacher full list of apparatus and materials needed for each experiment. The whole scheme of instruction is admirable in this book for it exemplifies the true Nature Study principles of working out each science from the child's standpoint.

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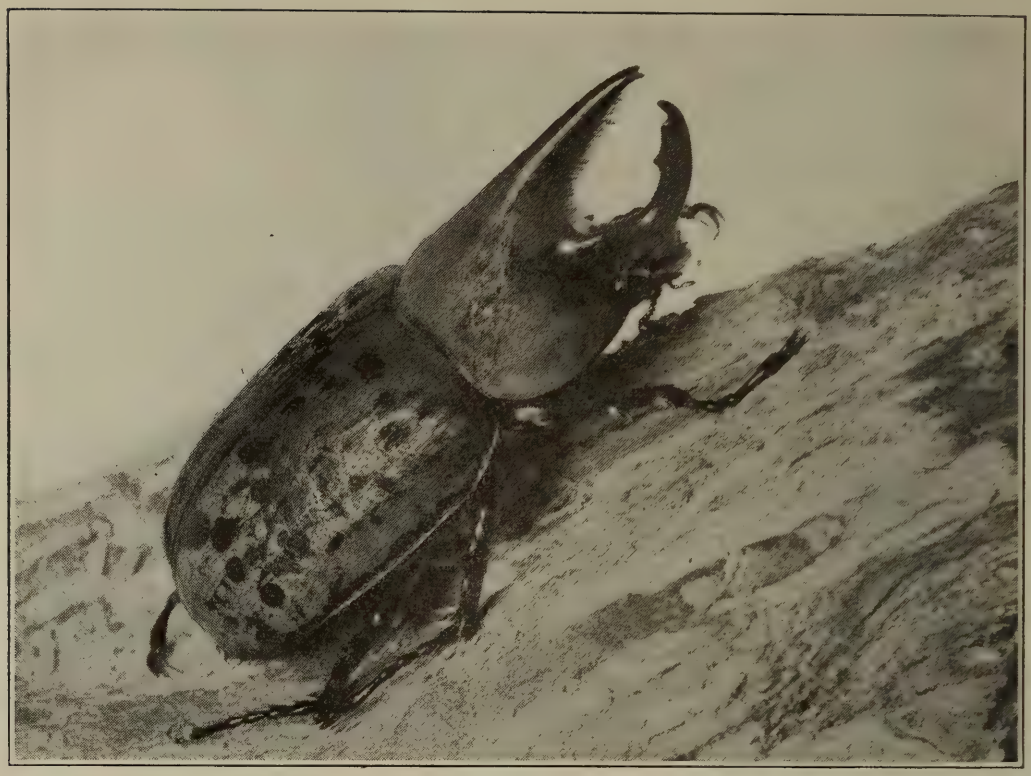

The largest beetle in North America
Photographed by Dr. R. W. Shufeldt

TABLE OF CONTENTS

The Largest Beetle in North America. Dr. R. W. Shufeldt	325
Bird Song. T. D. A. Cockerell	326
Clover. Adeline M. Wenger	327
The Tree Shells of Hawaii. Vaughn MacCaughey	334
A Seven-Year-Old Ornithologist. E. D. Everdell	337
The Fresh Water Pearl Makers. Dr. N. M. Grier	338
The Robin Junior Audubon Society. M. B. Birkicht	344
The Pine Tree and the Man in The Moon. Jay Traver	345
Under a Pine Tree. F. W. Bourdillon	349
The White Pine. M. F. Lumsden	350
Editorial	354
Annual Meeting of the American Nature-Study Society	355
News Notes	356
The Book Shelf	361

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The Largest Beetle in North America.

DR. R. W. SHUFELDT
Washington, D. C.

We have a good many big beetles in this country; but there is not a species among them that in any way approaches in size the Spotted Horn-Beetle of the Southern States—the scientific name of which is *Dynastes tityrus*.

Not long ago the United States National Museum kindly loaned me a specimen of this handsome insect for a special purpose, as I did not happen to have one in my own collection to photograph. It made a good subject, and a reproduction, natural size, from my negative illustrates this brief article.

This Horn-beetle is the largest of all North American Coleoptera —indeed, there are but few of greater size in all the world. As will be noted from my illustration, the male—for it is a male—of this species has on his head a conspicuous forward-projecting horn, with a still larger one on the thorax. These horns curve slightly towards each other, and are absent in the female, she having only a small knob on her head. He also supports two much smaller horns on the thorax.

The *Dynastinæ* is represented by several other large beetles, and they are generally known as Rhinoceros beetles—a very good name for them. In south Europe there are a few small representatives of them, but none in Great Britain; and excepting these, the remainder of the subfamily is found only in warm climates.

Most of them, if not all, possess, I believe, a very disagreeable, musky odor, and this is likewise true of their larvæ, which latter feed upon the wood of various trees.

Our *D. tityrus*, on transforming from the pupa, is unspotted, and of a untinted, dark brown color; as it matures, however, it assumes a greenish gray shade, while irregular black spots of various size are scattered over the thick and shiny elytræ. With-

out any apparent reason, the right-hand elytra in the specimen shown in the cut turned a deep earth-brown while it was in my possession, and this happened while it was in the usual insect-box used in museums and elsewhere.

Mr. Hoffman, a young friend of mine, recently collected a female of this beetle at Great Falls, southern Maryland (Potomac River); it was walking on the ground. Personally, I have only seen them in nature in southern Louisiana. The places to look for them in the Southern States are in old stumps and decayed logs, and the people in that section of the country generally call them the Spotted Horn-beetle. A fellow with a still larger horn—in the case of the male—has been described as another species; it occurs, I believe, in various localities in the West.

In the West Indies we find the Hercules-beetle of this group; it has a very long horn on its thorax, and is the largest living true insect in all the world at present known to us (*Dynastes hercules*). *D. neptunas* is also a big representative of the group, and is found in Columbia. This latter insect is black, while *D. hercules* is of a fine gray color, inclining to olive. Its horns are enormous and very long—indeed, fully *six inches* in some specimens. Nearly all the species, however, of the *Dynastinæ* are either black or dark brown. In some of the genera the long horns of the males are bifurcated distally, or really *bidentate*. in still others the head horn is the most conspicuous one by all odds, while the one developed on the thorax is much subordinated. A fairly good figure of *Dynastes neptunas* is given by Kirby (Plate XI., fig. 1), and the other species have been figured by various entomologists.

Bird Song

Entre nous,
Je suis heureux,
Et plus, que voulez vous?

—*T. D. A. Cockerell.*

A typographical error in our last issue gives us excuse for printing again this exquisite little poem.—*Editor.*

Clover

ADELINE M. WENGER

Teacher of Nature-Study in The Riordan School, Highland, N. Y.

June may be considered by many to be the month of roses, but does it not also suggest the sweet scent of the clover and the dull hum of the bee, who puts forth her best efforts to prove to me and you and all lovers of Nature that she is "in tune". She sees with her bee intelligence and her trust in God's good providence, that before her lie busy labors and a summer of sweet peaceful scenes. Can you not hear in her song the story of clover blooms,—of their wondrous sweetness, the secret of which by close companionship, she alone can describe? Adele Stanton must have heard it when she wrote:

Red clover blossom

Oh, a song to the clover
That sweet field rover
Which the bees riot over
  Their thirst to stay;
In whose depths the sky plover
Hies to find cover,
Where maiden and lover
And children stray.
Oh; the cool fragrant places,
Strewn with the graces
Of the pink and white faces
  Breathing perfume!
Where the country wind races
Laden with traces
Of swept over spaces
  Of clover bloom!

I chose a sunny morning in June for my visit to the haunts of the clovers. Bobby, an inquiring boy of ten, a true lover and student of Nature, also seemed much "in tune" and I knew would be a sympathetic companion. Equipped with a collecting can, a

list of the true clovers and their characteristics to which we might refer, and a tempting lunch for each, we started out with the vision of a happy day before us.

Miss Bumblebee greeted us with a mumbled "boom"as she rose from the home hidden in the hayfield, intent upon filling her pollen baskets and gathering nectar for the growing young family in the nest. She had scented a big head of red clover blossoms standing above its sister clusters. Some of the blooms, those at the base of the head, were awaiting her arrival, for had they not sent out perfumed invitations by messengers of air? Others, near the top of the cluster were not yet ready for guests,—their feast was but being prepared behind closed doors.

"Hum! Hum!" and a long ribbon-like hairy tongue found its way to the end of a long tube, where Miss Bombus had long ago learned there is nectar to be found. "Come! Come!" she sang as she drew it out. Bobby and I did come, as she bade, but not without noticing that she had been dusted with pollen as a parting souvenir of her visit.

From one sister blossom to another she climbed. The clover head that had stood so straight and sturdy before she alighted, bent over with her weight, and it seemed as if all must end in a catastrophe either to the blossom or bee. Our fears were groundless, and amazed, we drew closer still to see the reason Muir beautifully expresses it when he says,

"Bees . . . hug their favorite flowers with profound cordiality, and push their blunt, polleny faces against them like babies on their mother's bosom. And fondly too, with eternal love, does Mother Nature clasp her small bee-babies, and suckle them, multitudes at once, on her warm Shasta breast."

Very carefully examining a tiny red blossom, which the bee had just left, we disclosed some of the secrets that that had been whispered so shyly and sweetly to its ardent lover. We pass the secret on to you.

Beneath each delicately striped banner, in a tiny pocket which is flanked on right and left by wing-like petals, are hidden nine delicate stamens. These hold out their anthers on slender filaments. Eight of them unite to assist in forming a tube reaching backward almost half an inch to the nectary,—the source of sweetness. Between these stamens, pushing its way through their midst, is the pistil, its thread-like style holding a rounded stigma above the heads of the anthers, and leading back to the far end of the tube.

where it terminates in a miniature young seed pod or ovary. The remaining stamen follows the lead of the pistil and fastens itself at the base of the nectary. All these are held within a dainty five pointed green calyx.

Wise little blossom! How well you seemed to know that Miss Bumblebee must pull open your keel-like pocket in her hurried, clumsy efforts to reach the feast prepared for her! And then you played a trick upon your visitor by dusting her with pollen as she brushed against your stamens when departing! Your sister seems just as wide awake as you, for she shed her pollen a little earlier than you, and immediately set to work to prepare her stigma for a future visitor. She still has nectar with which to tempt, and will claim some pollen upon her waiting sticky stigma as a reward. Bobby and I know that the powdery gold will find its way down the slender tube of the style to the ovary and that there it will help the seed to grow. We know, too, that the bee will carry home some of your gift to the family there. A wonderful secret partnership, bringing joy to you both—a life-preserver for the coming generations of bees and clover!

Bobby discovered that the reason the blooms at the lower side turn brown before their sisters occupying higher seats, is because they wish to signal to the bees that their services are no longer needed.

Nearby we found one head more elongated and shaggy, with bonnets of brown, or none at all, for the wind must have carried some of them away. In each, well protected by each remaining calyx, which had also donned brown to replace her former dress of delicate green, lay the ripening seed. A large family indeed, grouped together on that one stalk each member holding within itself the possibility of perpetuating its kind with its own peculiar characteristics.

As we pulled up a fine specimen for my collection, Bobby noticed many tiny swellings on the roots. At first he thought they were particles of soil and tried to shake them free, but they clung tenaciously. Immediately his eyes shone with the light of interest that characterizes a boy of his type, and I could read these questions, "What are they? What are they doing there?"

We walked along slowly as I told him the wonderful story of the bacteria living in those queer little rounded nodules,—that they are

Yellow Sweet Clover

so minute it requires about 25,000 of them put end to end, to reach an inch, —that they extract nitrogen from the air and change it so that the clover can absorb it,—and that when the roots are left in the ground after the clover crop is harvested, the soil extracts the nitrogen from these well-filled storehouses.

We had become so absorbed in our conversation that we had not noticed the approach of Farmer Brown's wagon.

Farmer Brown is an up-to-date man, always ready to get and give valuable information. Overhearing Bobby's "My! but I never thought there was so much to learn about clover!" he inquired into the subject of our interest. Hearing of our morning's discoveries, he pointed his whip toward a crop of clover that grew on a hillside not far distant.

"A number of years ago," he said, "the soil in that field was so poor that it hardly seemed worth the plowing. I heard of your wonderful bacteria story and planted it in clover. From that time on the soil produced better crops. Now, every three or four years one or another of the clover family is planted in one of my fields. And, too, I've always found that because the roots are so long and fibrous they prevent wash outs when we have heavy rains and freshets.

"Crimson clover makes an excellent crop for covering the ground in winter. It keeps down weeds and keeps the ground from losing too much of its mositure by evaporation. Besides it acts as a good fertilizer when I turn it under in the spring.

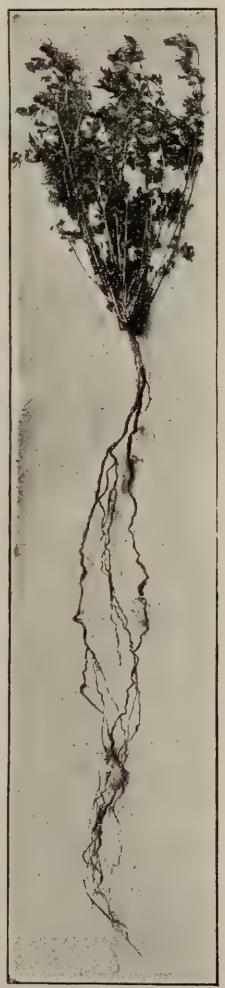
"Then I've used white clover seed on my lawn. Have you ever noticed how flat it seems to be compared with other clover? That's because the stem has a queer twist which brings its leaves close together.

"You'll find some sweet clover a little further down the road. That's used, too, to enrich the ground, and will even grow as high as four feet on poor soil.

Alfalfa in leaf and blossom

"I read in one of my agricultural papers that sometimes as much as $2,000,000 worth of clover seed is exported from the United States in one year. But don't forget that the bees help us do that.

"I'm on my way now to see how my neighbor's alfalfa crop is coming? You know that's really a cousin to the clover and must have a supply of bacteria in order to do well.



Alfalfa showing root tubercles

"We farmers find clover hay to be nutritious for our cattle. I've noticed that my cows don't favor the hay of sweet clover because it has a strong odor, but they'll eat it when other green forage is scarce.

"You'll find a fine field of white clover on Mr. Wood's place. He raises it for his honey bees, for he has had more and better honey ever since he started using it. Now I must drive along."

A light wind carried the scent of Mr. Wood's white clover in our direction, as we walked along. The sun, now high in the heavens, shone down warmly, a gentle breeze was blowing, and hundreds of bees hummed drowsily as they worked among the flowers. Bobby and I felt a bit drowsy, too,

but stopped to look and listen, and hearing no discordant note, decided that all was "in tune."

A specimen selected for our can showed that it too, bore the characteristic nodules on the roots. We also noticed that the lower blossomes showed a peculiar habit of hanging downward as they turn brown, seemingly a double way of signifying that the work of the bee is finished.

White clover

Though our can was scant of specimens we felt that our morning had been profitable. Refreshing ourselves under an inviting old oak, with our lunch, and a rest such as Nature offers in her quiet, unassuming way, we again started out.

Now one plant after another was added to the red, white and sweet clover already there—yellow or hop clover, yellow sweet, black medick, alsike, crimson, rabbit-foot so soft and gray, and even a few four-leaf clovers which Bobby insisted on putting in for good luck. We found them by the roadside and in fields, some showing preference for a richer foothold than others, each showing that though she is a member of the family Leguminosæ Trifloium, she wished us to know that she shows characteristics that distinguish her from even her nearest relative.

Mabel Osgood Wright in her book "Flowers and Ferns in Their Haunts has Time-o'-Year say, "Take jist common clovers, now, not growin' in fields for a crop, but strayed out by themselves here along the road. There's lots to see in 'em—differences o'leaf and blossoms, and it must be allowed few plants is so purty and neat and useful all to onct."

Bobby hopes that some day the clovers will hold a reunion when each member of the family can arrange to be present and will tell something about herself and her wanderings. I, too, believe it would be a rare treat to listen to their stories, for I understand that originally some came to this country from Europe and some from Asia, and I know that Red Clover has something very interesting to tell of her trip to Australia.

Though Bobby was tired and ready for bed as soon as he had finished his evening meal, he was willing enough to listen to this bit of poetry by Helena Jelliffe which I was fortunate to find before he fell asleep.

The clovers have no time to play,
They feed the cows and make the hay,
And trim the lawns and help the bees,
Until the sun sinks through the trees.
And then they lay aside their cares,
And fold their hands to say their prayers.
And drop their tired little heads
And go to sleep in clover beds.
Then when the day dawns clear and blue
They wake and wash their hands in dew;
And as the sun climbs up the sky,
They hold them up and let them dry;
And then to work the whole long day;
For clovers have no time to play.

Nomination of Officers

The following officers are to be elected at the meeting of the American Nature-Study Society to be held in Chicago, December 28th, 1920:

President

Five Vice-Presidents

Five Directors to act for three years

Nominations of persons to fill these offices should be sent before December 20th to the editor of the NATURE STUDY REVIEW. While we have no desire to "steer" the elections of officers of our Society, we feel impelled to state that Professor J. Andrew Drushel has proven himself such an enterprising and excellent executive during the past year that it is manifestly for the best interest of everybody except himself that he be re-elected for the coming year.

ANNA BOTSFORD COMSTOCK,
Secretary-Editor.

The Tree Shells of Hawaii

VAUGHAN MACCAUGHEY
Superintendent of Public Instruction in Hawaii

The snails in most countries creep about on the ground, among the dead leaves, or on low vegetation. They feed upon decaying plant material and are found in moist localities where such food is abundant. In the Hawaiian Islands, far out in the middle of the North Pacific Ocean, there are many beautiful snails that live up in the trees. There are about 400 kinds in the Hawaiian forests, and none of these are to be found anywhere else in the world. There are no tree-snails in the mainland United States.

The Hawaiian tree-shells first became known to Europeans through a shell necklace carried back from Hawaii to London by Captain Dixon, the circum-navigator, about the time of the American Revolution. From that time until the present, the Hawaiian shells have been eagerly collected by almost every naturlist who has lived in the Islands.

The woodlands of Hawaii are very different from those of temperate regions. Many of the forests are exceedingly wet, so rainy that they are called "rain-forests". The ground is soggy and covered with ferns. The trunks and branches are heavily clad with wet mosses. Tree-ferns are abundant in the rain forests. The snails are plentiful in these rainy mountain woodlands, which are at elevations of 1000 to 6000 feet above the sea. Some of the snails creep about in the wet rubbish on the ground, but most of them live up in the trees and bushes, from five to fifty feet above the ground.

The average length of the mature shells is from one-half to one inch. They are practically all cone-shaped spires, with a relatively large opening and graceful outlines. The shell is strong and rigid in proportion to its size, but not thick enough to prevent the mountain rats from gnawing holes through it for the sake of the juicy meat within. The mountain rats were formerly abundant and among the chief enemies of the snails. Like the spiral shells of other regions, some turn to the right and some to the left.

The shells are beautifully colored. There are various tints of brown, cream, gray, green, yellow, and pearly white. Many kinds have conspicuous dark spiral bands. Some are plain white or gray. Nearly all of them are brightly enamelled. A cabinet

of these shells, cleaned and arranged, is a decidedly attractive natural history exhibit.

The Hawaiians have an interesting superstition to the effect that the little tree-snails can sing. At night in the forest the chirruping of the crickets is very noticeable. This was probably confused with the snails by the simple-minded natives. Certainly no white man has ever heard a tree-snail sing! Although the Hawaiians are very fond of various kinds of sea snails, they did not use the tree-snails for food; at least, such use was rare. Occasionally they would string the bright shells in necklaces or garlands.

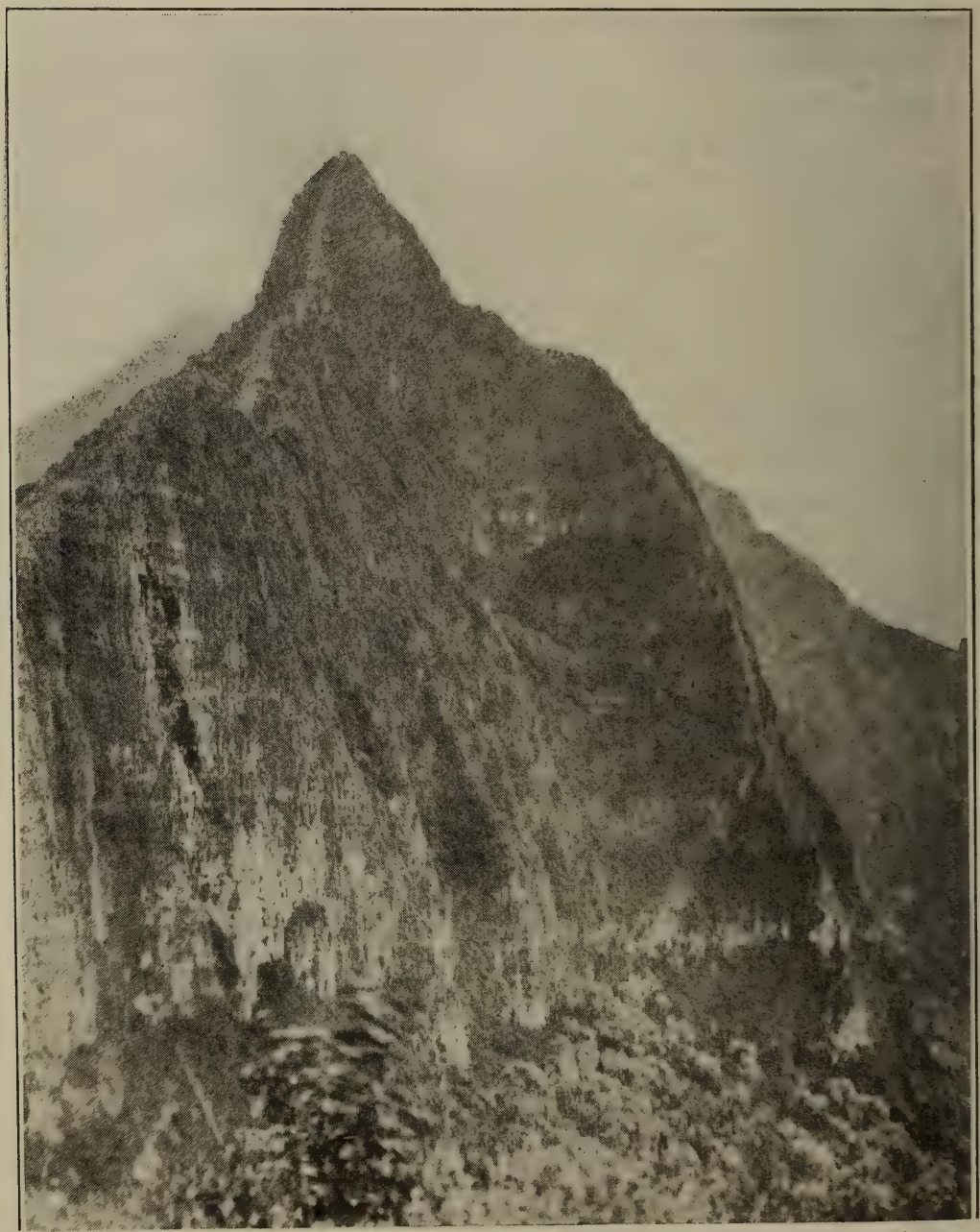
Some of the snails lay eggs; other kinds give birth to fully hatched young. The food of the snails is more or less of a mystery. They glide along the surfaces of the leaves, but apparently do not remove any of the substance. It has been suggested that they feed upon the delicate fungus material which grows upon the leaves, and which is almost invisible. At any rate they do not eat holes in the leaves, as do ordinary garden snails and slugs.

Not only are the Hawaiian tree-dwelling snails found nowhere else in the world, but their geographic ranges in the islands are very limited. Many kinds can be found only in certain very small localities, a few square rods or acres in area. Those kinds which inhabit a certain ridge or slope may be entirely different from those upon another ridge only a fraction of a mile away. Each valley-side has its own kinds of snails. Shells that were fairly abundant fifty years ago are now upon the verge of extinction. This is due to zealous collectors, as well as to the destruction of the forests by man, wild goats, insect pests, and other agencies. Anything that injures the forest injures all the native life within the forest; thus many of the Hawaiian tree-snails and also beautiful birds have become excessively rare.

Nearly every American boy in Hawaii at some time or other has made a collection of tree-snails, or "land shells" as they are called locally. Many scientists from Europe and America have devoted much laborious research to this remarkable group of molluscs. In Honolulu are a number of very large and complete collections of the tree shells,—collections that represent the labors of many decades, and that are of great scientific value. To open one of these cabinets is like uncovering an exhibit of precious stones. The successful "shell collector" must have sharp eyes, strong legs, and plenty of patience. The snails are motionless among the dense foliage and are easily overlooked An amateur will gather

two or three along a bit of trail where the skilled hunter will collect twenty or thirty. The collectors are very jealous of their finds, and studiously conceal all knowledge of the location of the best hunting grounds.

The tree-snails of Hawaii have been of much assistance to science, in helping to unravel some of the difficult problems concerning the formation of the Hawaiian Archipelago, and its relation to the other island worlds of the great Pacific.



Tree snails occur in the summit forests of this typical Hawaiian peak. Hani-Huli, Oahu, height 2781 feet.

Photo by Vaughan MacCaughey

A Seven-Year-Old Ornithologist

ENDELL D. EVERDELL
Miami Conservancy, Englewood, Ohio

Near where the Englewood Dam is being built under the supervision of the Miami Conservancy District of Dayton, Ohio, is ten acres of wooded land, a natural habitat for birds. Located in this spot is a cottage school for the children whose fathers are building this immense structure. In this school is an embryo ornithologist, a little boy not quite seven. He has found and identified the following fifty-two birds in these woods. His home is just a few rods from the school. His father, the Division Engineer, drew each night for several months, a bird for his son, explaining the size, coloring and beak. During the day, little Richard McCurdy would watch the birds until he found the right one. Sometimes he used his father's glasses. He also had a copy of Burbank's Bird Book and Reed's Bird Guide at school to aid him. On the cover you see him as we caught him one day with his father's glasses.

List of birds Dick has seen in this neighborhood:

House Wren	English Sparrow	Song Sparrow
Slate-colored Junco	Robin	Bluebird
Phœbe	Kingbird	Bob White
Red winged Bl'kbird	Flicker	Red headed Woodpecker
Downy Woodpecker	Baltimore Oriole	Blue Jay
Meadow Lark	Tree Swallow	Barn Swallow
Kingfisher	Sandpiper	Nighthawk
Redstart	Yellow Warbler	Cardinal
Catbird	Crow	Scarlet Tanager
Brown Thrasher	Chewink	Wood Thrush
Oven Bird	Mourning Dove	Goldfinch
Chickadee	Nuthatch	Screetch Owl
Yellow Billed Cuckoo	Cowbird	Purple Grackle
Lark Sparrow	Wh.-crowned Spar.	White-throated Sparrow
Indigo Bunting	Blue Grosbeak	Black and wh. Warbler
Chest. sided Warbler	Bl'kburnian Warbler	Maryland Yel. Throat
Yel. Breasted Chat	Mocking Bird	Tufted Titmouse
Turkey Buzzard	Ruby throated Hummingbird	

The Fresh Water Pearl Makers

Dr. N. M. Grier
Washington and Jefferson College, Washington, Pa.

While most of the large group of animals known as the Mollusks are capable of forming some sort of pearly secretion as a protection against irritating objects, the group among them which becomes more important each year in an economic sense is that of the pearly fresh water mussels or Naiades. Known colloquially as clams, they are familiar objects to many boys and girls who early learn to trace them along the bottom of creeks and rivers by means of the curious, winding and groove-like tracks portrayed in the illustration. Some kinds of them do not move about as much as others, but all of them habitually lie embedded in the bottom, with the hinder, (larger), end of the shell directed against the current and slightly gaping, when they may be recognized if the water is sufficiently low and clear, by the slit like appearance in the bottom. Man has learned to take advantage of this peculiarity of the animals, for when it is desired to collect mussels for commercial purposes, hooks are dragged on regions of the bottom where clams are plentiful, and if such encounters the opening of the clam, the latter closes its shell upon them, and even after a considerable interval may be hauled up to the surface and pulled off. Depending upon other conditions, various types of rakes and nets are also used for securing the clams.

Related more distantly to such animals as the pearly Nautilus, the squids and octopus, and to the univalved snails—from which latter type of animal evolution supposes they have proceeded,—these bivalved animals are fundamentally similar in structure to their relatives of the seacoasts—the oyster, hard and soft shelled clams, scallops, edible mussels, etc. Gastronomically, they have never received any equivalent appreciation and perhaps deservingly so, for while their meat is used for bait, or is sometimes fed to poultry and pigs, human demand for it has never been great enough to warrant the necessary separation of this aspect of their utility from that of collecting them for shells and pearls alone. Like all of their relatives however, the fresh water mussels are rich in most necessary foodstuffs—protein and glycogen—facts unknowingly appreciated by those sections of the country using them for food as the Indians are thought to have done.

Above. The mussel on its travels showing the gaping of the shell, the mantle and the protrusion of the siphons. Below. Showing the natural home and wanderings of a fresh water mussel.

Drawing by J. F. Müller, College of City of Baltimore.

Points of interest concerning these animals are best understood if we recall more important points of their structure. A real teacher among Zoologists has compared them to a book in which the covers are represented by the shells, and the fly leaves by the lobes of the mantle, the latter being a membranous covering of the animal's body which both lines the shell and secretes it. The halves of the mantle, like the halves of the shell, are curved and thus enclose a space, the mantle cavity, which is partly filled by the gills, foot, and the rest of the body. But two structures besides the shell and foot appear to have regular contact with the outside world. These we shall term the inhalant and exhalant siphons, and they take, as seen in the illustration, the form of two tubes, one above the other, which the animal is able to protrude or contract from the posterior, (larger) end of the shell. These portions of the creature's body as well as the lower edge of the mantle seem well provided with sense organs. Irritation of them or disturbance of the water causes the shell to close up "like a clam." It is additionally known that the senses of smell and possibly taste also exist while some are sensitive to light. Through the lower siphon, a current of water may be drawn in which bears not only oxygen for respiration, but also the minute animals, plants, organic debris upon which these creatures feed. The gills remove this oxygen from the water, while the food material is swept into the mouth at the opposite end. Material useless for food leaves the body through the exhalent siphon, assisted by the current of water leaving the gills.

When it so happens as has often been inexcusably the case with so many of our finest rivers, that the surroundings of the mussels become polluted with wastes preventing the development of the small organisms on which they feed, or with organic matter which absorbs the oxygen from the water, it follows that such conditions will neither permit the clams nor any but the hardiest forms of animal life to survive. The clam can only temporarily close its shell, a protection it is soon forced to relinquish from lack of the necessities of life when the elastic hinge of the shell overcomes the resistance of the muscles keeping it closed. Clearly there is need of a different sentiment toward our streams and all of their natural beauty. However, more natural enemies of the fresh water mussels are the muskrat, before whose burrows piles of dead shells may be found and certain birds which have learned to fish for them and drop the shell from on high to break it to obtain the soft parts.

Most remarkable organs are the gills, for in the outer two, and sometimes in all four, are deposited the eggs by the parent animal. Here they undergo the first stages of development and transform into minute creatures termed *glochidie*, possessing a bivavle shell beset with teeth. After a time, they are discharged, either through the exhalant siphon or small holes in the edge of the gills. The glochidia are able to open and close their shells rapidly when in the least disturbed, and this may result in their attachment to the fins or gills of some passing fish—an occurrence necessary for their further development. Shortly they become embedded in the flesh of their host, and although their exact relations are not understood, in a few weeks they "undergo a wonderful series of changes," resulting in the production of a small mussel. The latter soon breaks through the thin skin of the fish and drops to the bottom, setting up in business for itself. After a growth period of five years it may attain its mature size, and thereafter may live 30 years or more.

Frequently mussels are found discharging their young during the summer months. Each little animal is but one of thousands of white specks surrounded by a gelatinous material. The interesting thing about the process as it has been described, is that each kind of mussel has its own kind of fish host, and if such is not found, the little animal perishes in two or three days. We thus rarely find a variety of mussels in streams not possessing a variety of fish and some of our most worthless fish from an edible standpoint, i. e. the gars, are invaluable because they, and they alone can carry with them the young of mussels whose shell possesses an economic value. The shells of the few kinds which can develop independently of the fish are worthless commercially.

The foot is usually of a yellowish white color and of a tough muscular consistency. It probably presents the greatest obstacle to the utilization of the fresh water mussels for food, since this structure does not attain comparatively such a development in most of the edible marine bivalves. By means of the foot, the animal leisurely ploughs its way through the mud as indicated in the illustration, and if a mussel be taken out of water, the foot is seen to slowly contract and be withdrawn steadily into the shell. It is also of use as a burrowing organ which enables the animal to sink deeper in the moist mud in time of drought, or raising it when overwhelmed with the suffocating mud of the spring freshets.

"Mollusk" means soft-bodied, the significance of which term we realize more fully when we examine the beautiful and smooth mother-of-pearl with whcih the shell is lined, and whose origin has already been indicated. No more beautiful pigments have ever appeared in paintings than those represented in nacre, as this portion is scientifically known. Here is the original of the well known pearl blue shade, rich purples and lilacs, blushes rivaling those of the rose, salmons and the purest of whites. Unfortunately vividness in nacre color detracts from the commercial value of the shell, as the public desires mostly white buttons. Yet colored buttons could be equally serviceable on less conspicuous garments, and the great piles of wasted shells often to be seen along river banks better utilized. The war has taught us that fads may be utilitarian as well as otherwise.

When minute, irritating objects such as small worms or grains of sand find their way into the sensitive soft parts, they are in time interred in that elegant mausoleum we term a pearl, which is nothing more than concentric layers of crystalline calcium carbonate, (lime) deposited upon a nucleus of the type mentioned. The thicker shelled animals seem to produce the best pearls, and while there may be all shapes of them such as slugs, baroques, etc., those which are most nearly rounded off are the most highly prized. It has been thought that the shape of these depends on the relative freedom of motion encountered while developing. Salt water pearls are the most valuable, and it is interesting to know that both kinds may be produced at will in an animal—an accomplishment not every one is versed in. Frequently the pearls are tinted with a suggestion of the color of the nacre or of the soft parts, and this may either enhance or detract from their value. There is now reason to believe that the coloration of both is related directly to the chemical content of the surrounding water, while the latter in turn may be associated with geographical conditions since the brighter colors in some shells are found up stream. Similar conditions apparently affect the outer covering, or epidermis of the shell.

Pearls are of value because good ones are scarce, and conditions are unfortunate for the mussel fauna of a region where "pearl fever" is rampant. Not only have thousands of animals been uselessly killed in the quest for pearls, but their valuable shells useful in the button making industry, have been wasted. Worse than that, natural propagation among them was terminated by taking

the shells before the *glochidia* were ripe. Several states have passed laws protecting the mussels at certain seasons of the year, and so arranged as to protect the pearl button industry. Sentiment should be crystallized among the people to the effect that a mussel should not be killed unless the fullest use be made of all parts of it as indicated herein. Broken shells may be ground up for feeding to poultry.

The scientific facts stated as probably affecting the coloration of the shell, are in general those affecting the character of its growth. Where lime, or its antecedent limestone is scanty in the water, the shell is found to be quite thin, and in some cases, quite soft. Beyond stating that the beautiful painting and banding of the epidermis seems more characteristic of the smaller creeks and rivers, etc., no suggestion may be offered as to its significance, except, as with the nacre, it represents a response to the environment. Upon the above mentioned qualities of the shell largely depends its availability for button making, the more important economic use. For a good quality of button, is required a shell of pure color, neither too thick nor too thin, nor too hard to cut. The value of the raw shells yearly collected for this industry approximates $1,000,000; the finished product of course much higher. These pearls, incidentally collected may range well up into the hundreds of thousands of dollars. No public school should be without a demonstration showing the steps of manufacture from the raw material to the finished product. Such may often be obtained from button manufacturers. The increasing scarcity of high grade button material indicates that a rigid program of conservation must be adhered to. The variety of shapes and characters of shell architecture has suggested the common names by which they are known. Thus we have "pocketbook", (see illustration), "lady finger, squaw-foot, wash board, maple leaf, three horned wart back, elephant ear, butterfly, pistol grip, etc." The age of a shell may often be determined by counting the rest from growth rings to be seen upon it, but this is not always accurate.

The fresh water mussels furnish outstanding examples of the wonderful interrelations existing in nature, and how living things are largely the product of their surroundings, living and non-living, interacted upon by them and with them. Unlike their hardy relatives the snails, they do not usually thrive in indoor aquaria, but are susceptible to pond culture. Their further study quite bene-

ficially compels us to go afield, but the attention we must thereby give, reveals many remediable defects in our economy of natural resources and natural beauty.*

The Robin Junior Audubon Society

Mary B. Birkicht
Longfellow School, St. Louis, Mo.

One day in April, 1919, four boys playing in the woods near their home in a suburb of St. Louis, noticed a strange bird. Their interest became so intense that they called at the writer's home in the neighborhood and urged her to go and see the bird and if possible to tell them what it might be. From that moment those boys became active bird students.

They decided to form a club and succeeded in doing so in September in their school, the Longfellow. Three of these boys became its officers. The members used as a basis for their study the information given on small cards gotten from soda packages. This was supplemented later by Audubon Leaflets and Library books. They so aroused the interest of the pupils in the school that by the end of the term, June, 1920, one hundred and ten members had been enrolled.

When the Bird Club of St. Louis made its annual trip in December to study the winter residents, the President and Secretary of this society accompanied it. Their list was an excellent one for amateur bird students, the president being thirteen years old, the secretary, eleven.

In the spring the club held a most pleasing exhibition of bird houses. In many cases the parents assisted, but the boys mostly did their own planning and building. One house, a pretty little rustic affair covered with bark, so attracted the attention of a gentleman when the owner was carrying it home, that he as given three dollars for it.

The whole club was wide awake. They studied books from the library, cut clippings from papers and magazines, and hunted nests

*Those interested in obtaining full information concerning the button industry and the fully detailed natural history of the Naiades will do well to consult the instructive publications of the U. S. Bureau of Fisheries, especially Doc. 865, "The Fresh Water Mussels and Mussel Industries of the United States," by Dr. Robert E. Coker. Bull. Bureau of Fisheries, Vol. 36, 1917–18.

and watched the young grow. Any destruction of nests or young became quite a serious matter with them. Their interest in the birds was so well known, that at Christmas there was a regular shower of Bird Books as gifts to the great delight of the recipients.

The one who feels that she has been benefitted most, is the teacher whom they "lured" into joining their club. Through these four boys she has become better acquainted with the bird life of the community, and rejoices in being able to recognize now so many of the bird friends. She hopes that some day the information gained from wood and field will be considered as valuable as that secured from books, and that the time will come when it will be the proper thing to have specially prepared teachers to take all the children out to the woods once or twice a week in spring and autumn and there study the varied and abaundant life that fills them. A partial remedy for the sordidness and discontent of the cities is to put the child into touch with the great out-of-doors.

The Pine Tree and the Man in the Moon

JAY TRAVER

It was eleven o'clock, and Roger had been in bed since eight, but he couldn't go to sleep. He lay very still in bed, and thought and thought. The big pine tree just outside the window was sighing in the wind that swept thru its branches. The big full moon looked in at the window, at Roger, and the little boy was quite sure that the Man-in-the-Moon winked at him, with his left eye, very slowly. Then strange things began to happen.

One branch of the pine tree was quite near the window.

Roger heard a voice it was strangely like the rustle and sigh of the pine tree—say, "Come out, Roger, come out and swing in the moonlight." So Roger got up very softly and stepped up on the window-sill. The branch of the pine tree was right beside the window now, so the little boy stepped out on it. He wasn't at all frightened for the pine branch seemed to reach out its arms to hold him. He crawled a little way up the branch and then sat still, and swung back and forth gently. Mr. Wind came along just then and gave the branch a push, and it swung out away from his window. The Man-in-the-Moon winked again very slowly—

it was his right eye this time—and the rustling voice spoke to him again for the second time. "Don't be afraid Roger I won't let you fall. I'm very strong indeed and could hold up a hundred little boys without being tired a bit."

Now Roger knew it really was the pine tree talking to him so he said,

"Aren't you afraid Mr. Pine Tree standing out here all alone?"

"Alone?" said the voice, "Oh no, I'm not alone. All my friends are here ariound me. See, there are Mrs. Maple and Mr. Oak in the yard, and the whole Mountain Ash family along the drive-way. The Locusts are near enough for us to talk to one another. And then I have many other friends besides."

"Mr. Wind and the Man-in -the-Moon are your friends too aren't they?" asked Roger.

Indeed they are answered Mr. Pine Tree. "Mr. Wind and I have fine times romping together, especially in the winter when Mr. Wind is blowing from the north, he is very strong and nearly every day we have a wrestling match. But I am stronger than he and I always shall be, as long as my roots hold firm and strong in the earth."

"Do you ever see Jack Frost, in the winter, Mr. Pine Tree?"

"Oh, yes indeed, he is another of my friends. He never paints my needles tho, as he paints so many of the leaves on other trees. He says that my needles are so pretty that he never would be able to make them any prettier."

"Don't your needles ever fall off?"

"Yes, but new ones are always growing. If you will look down under my branches you will find a whole carpet of brown needles that have fallen from my branches. But you see I still have new green ones all the time, so that I am dressed in green all the year round. See how my needles grow in bunches of five each. All white pines have needles growing that way."

"Have you any other friends Mr. Pine Tree?"

"So many I couldn't possibly count them. First of all there is Mr. Sun. He is the very best friend we trees have, for without him we could never grow strong and sturdy, and then Mr. Wind would knock us over the first time he came along. Then there is Madam Rain who washes all the dust off my leaves and gives my roots fresh water to drink. I like Mr. Snow and Mr. Hail too; you wouldn't think it to look at him, but Mr. Snow is sometimes

very strong, even stronger than I am. Once he broke off one of my limbs, that was because Mr. Wind forgot to visit me that day, so he couldn't help me shake off Mr. Snow."

"I think that was very unkind of Mr. Snow," said Roger.

"Indeed you must not say that", replied Mr. Pine Tree, a little angrily, Roger thought. "He was very sorry the accident happened. You see he doesn't realize how strong he is, and Mr. Wind nearly always comes along before he can pile on flakes enough to hurt me any. Besides he covers all the earth with a warm blanket in the cold winter, so that the little seeds under the ground won't be hurt when Jack Frost comes riding down from the north in Mr. Winter's arms."

"Have you ever been to the far north?" asked Roger, rather glad to change the subject.

"No, I have always lived here but my friends have told me of my many, many cousins who live in other countries. I have cousins in the north, almost farther north than any other trees can go. Then I have other cousins on high mountains, up so high that it is very cold, and not many other trees can grow. But they hang on tight to the rocks with their roots, and laugh as they wrestle with Mr. Wind. Often he twists their branches into queer shapes, but still they are stronger than he. We are fighters we pine trees. We don't like warm lands very well. The warm air there makes us feel weak and unhappy. We like the wind and the rain and the cold and Jack Frost. Then others of my cousins stand beside the sea and the big waves leap up at them and try to pull them down. I should like to see the ocean very much, and the mountains and the northland, but my friends tell me all about them, and then I drean about them and that is almost as good."

"What other friends have you, Mr. Pine Tree?"

"I have told you of some of my winter friends, but I have others besides. Little Mr. and Mrs. Chickadee and Mr. Junco come then and Mr. and Mrs. Nuthatch and the Brown Creepers. They help me by hunting for bugs and other insects under my bark that might hurt me. Once in a while Mr. Red Squirrel comes out of his winter home, on a nice sunny day, and scampers around in my branches. Sometimes Mrs. Owl comes to visit me for a little while too. But when spring comes then the birds return from the south, and what stories they have to tell us of the fine times they have had all winter. In the night I hear the wild ducks

and the geese flying by, and then soon the other birds are coming I am very busy then too, for I have to get my blossoms ready to open. You didn't know I had blossoms? Oh yes, I have many of them. And such a lot of yellow pollen dust as there is in them. Mr. Wind carries it far away with him to find other pine trees that need it. You see that instead of having Mr. Bee carry my pollen, as the poppy flowers do, I ask Mr. Wind to help. He is always very kind and carries it as far away as he can. Then my little seeds begin to grow in little cones that stand up like green candles that boys and girls have on their Christmas trees. It will be two long years—two summers, two falls, two winters, and two springs, before the seeds will be ripe. So you see I have to take good care of them all that time, and see that they have enough to eat.

Then in the summer all the other trees seem so proud of their fine new dresses, and of the birds that are nesting in their branches. Sometimes birds nest in my branches too, and then I am very careful not to wrestle too hard with Mr. Wind, lest I might shake out the little eggs that are in the nests. Mrs. Chipmunk comes to visit me sometimes, and Mr. Red Squirrel too, very often. Jack Frost is far away in the northland then but I know that he will come back before very long, and tell me strange tales of that country of the Eskimos where the nights last a whole half year, and the Northern Lights are so bright. Sometimes I see those lights but he says they are much more beautiful in the far north.

In the fall the seeds that began to grow a year ago, are nearly ready to go out into the world for themselves. Each one has a little wing so that it can fly away with Mr. Wind and find a new home for itself."

"It must have been a great many years since you were a little seed, Mr. Pine Tree," said Roger.

"Indeed it was," answered Mr. Pine Tree. "I am now 200 years old. That means that I was a tiny little tree just sending up my leader—that is the middle part of my trunk—when there were still many Indians left here. I was in a big forest of trees then, many of them white pines just like myself. It was hard to get enough sunlight but I managed to do it, and grew as fast as I could. Nearly all the other trees are gone now but here I am still. The Indians are gone too from this part of the country, for I never see them any more. You see I am much older than even your great-grand-father is, and he is a very old man."

"Oh my," gasped Roger, "I wish I were a pine tree," and then he began to feel sleepier and sleepier, and the branch rocked him to and fro, ever so gently. He remembered a song his mother used to sing to him sometimes. The pine tree seemed to know it too, for it began to sing:

"Rockaby, Roger in the tree-top,
When the wind blows my branches will rock."

It seemed to somehow be different from the way his mother used to sing it, but he was too sleepy to think much about it.

"I'm having such a good time Mr. Pine Tree," said Roger softly. Just then his mother came into the room to see that he was warm and conmfortable.

"He must be having a very pleasant dream," she said, and smiled as she kissed him good-night. But the Man-in-the-Moon winked again very slowly!—both eyes this time, first one and then the other. And the pine tree rustled and sighed as the wind swept thru its branches. They seemed to know all about it.

Under a Pine Tree

F. W. BOURDILLON

Beneath the swaying pine-tree,
That the fitful wind goes through,
I gaze on the widening landscape,
That fades in the far-off blue.

Soft is the voice, but solemn;
And with a dream—like power
It sways all thoughts and fancies,
And hallows the brief hour.

And like low music playing
Above in the organ loft,
The wind in the pine-tree moving
Makes music strange and soft.

For the trees have all their voices
Of light or earnest tone;
The aspen—elfin laughter,
The oak—a Titan's moan.

But the pines have caught the msesage
Which the wind bears from the sea;
And its voice is the voice of the ocean,
And its talk of Eternity.

The White Pine

M. Florence Lumsden
Ithaca, N. Y.

"There is but one tree—the White Pine."—P. *Parkhurst.*

The White Pine is the tallest, the most stately and the most beautiful of all our eastern cone-bearing trees. It is this tree which distinguishes our scenery from that of other lands. The great whorled branches which regularly stand out against the sky cause them to be admired by all. The White Pine attains a height of eight to one hundred seventy-five feet. It is found growing from Newfoundland to Manitoba, south along the Alleghanies to Georgia and southward to the valley of the Iowa river. In the Adirondacks it is found growing at an altitude of twenty-three hundred feet while in North Carolina we find it as high as forty-three hundred feet.

We find the White Pine mentioned in American History. During the seventeenth century all silver shillings and smaller coins that were struck in the colony of Massachusetts bore the device of a White Pine. Also in 1772 a clause in extenuation to one in

the charter of Massachusetts Bay read: "That after September 21, 1772, in New England, New York, and New Jersey, in America, no person shall cut or destroy any white pine not growing in any township or its bounds, without His Majesty's consent."

White pine cone.

As early as 1705 Lord Weymouth sent some white pine trees over to England where they were planted on his estate in Chelsea. Hence the English often speak of the White Pine as the Weymouth Pine.

The White Pine is an evergreen tree. This is perhaps due to the fact that the pine is a very ancient tree and belongs to the earlier ages when the climate here was different than it is today. Although the White Pine is not a deciduous tree, nevertheless it does shed its needles which drop off and form a soft brown carpet whenever they fall.

This tree bears the smoothest bark of all the pines. However, on old trunks it does fissure and separate into small plates but they are simply loose at the edges and do not scale off.

The primary leaves are thin, chaff-like, bud-scales. From their axils proceed the secondary needle-shaped evergreen leaves in small bundles of five. In cross section these needle-shaped leaves are triangular. The edges serrate. The massed foliage presents a pretty appearance; the needles are bright bluish green, soft, slender, delicate and are disposed in pretty tassels upon the branch. An attractive poem about pine needles is the following:

If Mother Nature patches
  The leaves of trees and vines,
I'm sure she does her darning
  With needles of the Pine.

They are so long and slender,
  And sometimes in full view,
They have their threads of cobwebs
  And thimbles made of dew!

The cones of the White Pine are long, slender, loose and terminal without spine or prickle. They open and discharge their seeds in

September. After this duty is performed the empty cones fall, starting in the Winter and falling off gradually until early spring. The cone scales are 1¼ to 1½ inches long, and seven-eights of as inch wide, oblong-ovate, slightly thickened at the apex, obtuse or nearly truncate. The seeds are a red-brown and are mottled in appearance. Each seed has a wing an inch long which aids it in gliding through the air when in search of a suitable growing place for the next year. The pattern of the overlapping scales of an unripe cone is intricate and yet regular. Under each scale is a twin seed box where two tiny seeds mature. The blossoming time of the White Pine is June. The light-brown staminate flowers are oval in shape, about one-third of an inch long and are surrounded by six or eight involucral bracts. The anthers have short crests and are also surrounded by six to eight involucral bracts. The pistillate flowers are cylindrical, subterminal, and about one-fourth of an inch long. They have scales which are pinkish purple on the margin. The peduncle of the pistillate flowers are stout and are clothed with bracts. The pollen is very abundant for the pine tree depends upon the wind to sift the pollen dust into the lifted cups of the cone scales which will close upon the treasure as soon as it reaches there.

The White Pine prefers good soil on either moist woodlands or uplands. A single tree grown in the open has a broad crown that often keeps its lower branches and these are borne to the ground by their own weight. Such a tree is very picturesque and a joy the year round.

All cone bearing trees have a central stem from which the branches come off in whorls, but so many things have happened to old pine trees that the whorls are not always seen. Each whorl of the White Pine contains five branches.

The top-most growing point of the White Pine is known as the "leader". It is this point that leads the growth of the tree upward. It stretches up from the center of the whorl of last year's young branches and there at its tip are the buds which make the branches of this year's growth. If the leader is harmed by insects or the weather so that it is killed one of the branches of the whorl rises up and takes the place of the dead leader. Sometimes a keen competition takes place and two branches fight for the leadership. If both are successful a two-stemmed tree results.

We find many poems about the pines. Who is not familiar with the following lines from Longfellow's Evangeline?

> "This is the forest primeval,
> The murmuring pines and the hemlocks
> Bearded with moss and in garments green, indistinct in the twilight
> Stand like druids of old with voices sad and prophetic,
> Stand like harpers hoar with beards that rest on their bosoms."

The expression "Bearded with moss" is more than a poet's fancy Tufts of gray moss are found on the trunk of all pines that grow in the damp, close, northern woods. The thread of this moss is round and fine like a hair, and a bunch of the moss constantly suggests the gray beard of an old man. This moss plays an important part in the domestic life of the northern Indians; it is in this warm soft substance that the Indian babies are packed for transportation on their cradle boards. Indian mothers go out and gather this moss by the bushel. It feels like linen on the tender flesh of the papoose. This moss being soft, resinous, aseptic and porous makes the small brown baby swathed in it as well off as his civilized neighbors in flannel and linen.

Economically the White Pine has been of great value. For years it was the chief lumber tree of the country; now it is very scarce, due in part to the cutting of virgin forests. Then, too, many white pines have been destroyed by forest fires. The White Pine has been used for most everything from house furnishings to the masts of ships. The wood is light, soft, straight-grained, free from knots and nearly so from resin. The complete extermination of the White Pine will be prevented, however, for promising young forests are springing up on many abandoned New England farms where nothing else will grow. But the White Pine refuses to grow on land devastated by fire. Horticulturally the White Pine has been used extensively as an ornamental conifer.

When the wind blows through the pines a sort of soft music is heard, the like of which no other tree can produce. Many times has the music of the pine been mentioned in poetry and the following entitled "Under a Pine Tree" by F. W. Bourdillon is very pleasing; this is given on page 349.

THE NATURE-STUDY REVIEW

DEVOTED PRIMARILY TO ALL SCIENTIFIC STUDIES OF NATURE IN ELEMENTARY SCHOOLS

Published monthly expect June, July and August. Subscription price, including membership in the American Nature Study Society $1.50 per year (nine issues). Canadian postage 10 cents extra, foreign postage, 20 cents extra.

Editorial

Nature-Study Examinations

Examinations during the processes of education should be to the pupils a joy and an uplift; unfortunately they are too often a horror and a degradation. Especially is the latter influence regrettable, for when a pupil thinks only of passing an examination rather than of the subject itself and its mastery, the result is a degradation of intellect and of spirit as well. In the ideal school of the future pupils will eagerly examine themselves because they will find it a pleasure and a help to do so. Then the examination will be an inspiration instead of an expiration of interest in the subject,—a feeling that after an examination is successfully passed that there is no need of remembering or thinking about the subject again.

Nature-Study is particularly susceptible to spoilation by routine examinations. The value of this study can never be measured by such means; the only real test of it is the continued voluntary interest of the pupil in the different phases of outdoor life and an eagerness to see and understand more and more. However, there are certain tests for facts ascertained which the pupils find interesting and helpful. Identification of species may be played like a game. For instance, in identifying trees by the leaves; after the leaves have been studied, a miscellaneous collection of leaves may be tagged each with a number up to fifty; each pupil should write fifty numbers down the left margin of a blank sheet of paper; then the leaves may be passed around and their names as identified by the pupils placed opposite the corresponding numbers; then let each pupil mark his own paper and compute his own grade. This exercise results always in a keener interest in the identification of leaves and invariably provides a pleasurable half hour for the class. Nuts and fruits may be identified in the same manner. Competitions in identifying bird species during the spring migration may also be played like a game with an ornithologist umpire to decide

doubtful questions. Butterflies and other insects in Riker mounts may be similarly dealt with. Another interesting test is the telling or writing facts about the life histories of animals, birds and insects; this will stimulate both reading and observation. After a class in junior science has been working upon the devices of flowers for securing cross-pollination, give them a new flower with the task of unravelling for themselves its hidden mysteries, instead of asking them to repeat facts already ascertained.

In our opinion it is the Nature Study Teacher's duty to lead a crusade upon the gory battle field of examinations and by constructive example show that the field should be red with poppies rather than with blood.

Annual Meeting of the Nature Study Society

Held at Chicago in connection with the A. A. A. S.

ROOM 303, EMMONS BLAINE HALL, UNIVERSITY OF CHICAGO

TUESDAY, DEC. 28, 10 A. M., 1920

PROGRAM

Twenty-five Common Spiders (Lantern) Mrs. W. L. Moffatt, Chicago
Michigan Dunes (Lantern) Mrs. W. A. Rowley, Chicago
Election of Officers
Annual Report of the Secretary-Editor

TUESDAY, DEC. 28, 2 P. M.

A Survey of Twenty Years Progress in Nature-Study

1. In Training Teachers (20 Minutes)
   Mrs. Anna B. Comstock, Cornell University, Ithaca, N. Y.
2. In Courses of Study (20 Minutes)
   Miss Alice J. Patterson, State Normal University, Normal, Ill.

Are there Minimum Essentials in the Course of Study? (10 Minutes)
Dr. Otis W. Caldwell, Director of Lincoln School of Teachers College, New York

3. In Providing Materials for Study (20 Minutes)
   Miss Ellen Eddy Shaw, Brooklyn Botanic Gardens
4. In Measuring Results (20 Minutes)
   Dr. E. R. Downing, University of Chicago
5. In Extension Work (20 Minutes)
   A. F. Satterthwait, U. S. Entomological Laboratory, Webster Groves, Mo.
6. Reaching and Training Rural Teachers (20 Minutes)
   Dr. E. Laurence Palmer, Editor of Rural School Leaflets, Cornell University, Ithaca, N. Y.

An informal luncheon is being arranged at which we hope all members will be present. The time and place of the luncheon will be announced at the meeting.

News Notes

News Editor - Cora A. Smith,
817 Poplar St., Erie, Pa.

ST. LOUIS

At the eleventh annual meeting of the St. Louis Section of the American Nature Study Society held September 17, 1920, the following persons were chosen to be the officers for the ensuing year: President, H. C. Drayer, Principal Jackson School; Director, B. G. Shackelford, Principal Byran Mullanphy School; Secretary-Treasurer, J. A. Drushel, Harris Teachers College,; members of the executive committee Miss Amelia Meissner, Curator of the Public School Museum, and Dr. Margaret E. Noonan, Harris Teachers' College.

The secretary in summing up the Section's activities during the year stated that nine meetings were held: six field meetings, one annual meeting, one night meeting for star study, and one luncheon meeting at the City Club in honor of Liberty Hyde Bailey.

The membership roll for the year consists of one hundred ninety-two names, twenty-seven of which are new. The secretary also announced that more than forty per cent of the present members have been with the Section for seven or more consecutive years; also that during the ten years' existence of the Section, eighty-five meetings had been held.

The following is the announcement of a field trip attended by fifty-two persons.

WEBSTER GROVES TRIP—SEPT. 18, 1920, (87th MEETING)

The autumn flowering plants are at their best now due to the recent rains and the continued warm weather. To take advantage of this condition, it is proposed to study a small priarie society containing a relatively large number of species near Webster. Take Meramec Highlands car (Manchester line)and get off at Algonquin (near Jackson Road and Lockwood Ave.) about twenty minute's ride from Maplewood. Those going should plan to reach Algonquin at ten o'clcok.

The time before lunch will be spent in a study of the region above named. The following plants among others can be found in bloom or in fruit: prairie sunflower, Jerusalem artichoke, heliopsis, rudbeckia, purple cone flower, coreopsis (three species), bidens (three species), silphium (three species), blazing star, two asters, four golden rods, wild lettuce (two species), rattlesnake master, iron weed, boneset, white snakeroot, prairie ragweed, thistle, oaks (five species), wild sunflower (two species), diodia, desmodium (tick trefoil three species), bush clover (two species), wild false foxglove, evening primrose, gaura, wild four o'clock, spurge (three species), croton (three species), wild ground cherry (two species), violets with cleistogamous flowers and fruit, Indian tobacco, partridge pea, rattle box, oxalis, Skinner's gerardia, agrimony, sweet clover, burdock, wild parsnip, water hemlock, cowbane, monarda, mountain mint, penstemon. There are sixty-eight species in this list. It is suggested that you bring it with you and check those species you see.

Edible and poisonous mushrooms are plentiful in Sherwood Forest. (Do not cook a mushroom unless you are certain that it is edible).

Mr. A. F. Satterthwait in charge of the U. S. Entomological Laboratory located in Sherwood Forest has invited the members to visit the laboratory. It is planned to eat lunch under the trees near the laboratory and to have Mr. Satterthwait make an informal explanation of the purpose of su h an institution.

Those who wish may return home after lunch. The others will find the walk west of Sherwood Forest along the Frisco right of way interesting.

It is suggested that a list be made of summer resident birds still with us. Other trips.—Monk's Mound (Cahokia Mound) and vicinity, October second or ninth. Allenton—Fox Creek, October 16, 23, 30.

Dues may be paid at the annual meeting or the first field trip, at the after noon college classes, or check may be sent to Mr. Drushel at the early convenience of the member.

CALIFORNIA

Information was recently sent out by the California Nature-Study League concerning the *Nature-Study Guide Movement* in our National Parks; and also concerning the *Save The Redwood League*, of California. The feeling uppermost in our mind after reading them is that of thankfulness that in these days of men's selfish efforts to harness nature for their own benefit, there are living, men of vision and of power who will devote their lives to the preservation of the natural wonders of our country. And at the same time these men are tireless in their efforts to teach an appreciation of nature, making us a country of nature-lovers.

Save The Redwood League

About the time, according to some authorities, that Moses and his people were suffering in the desert, a tiny seed, wafted by a Sierran breeze, left an opening cone and aeroplaned to the needled forest floor. It sprouted. Today it is the world's oldest living thing—a California Sequoia. When Alexander dreamed the same dream of world domination that later did the Kaiser, this redwood was a vigorous sapling. It was still young when Caesar ,gazing at the chalk cliffs of Dover, called England "Albion."

Our redwood fought and conquered all enemies, until one day there came into Sequoia-land a wave of men from that same Albion. These men were puny in size compared to the forest giant. Note the man in white at the cross in the photograph. These men, however, had skill with machinery, and, moreover, were money-hungry. They felled our redwoods and turned them into jingling gold.

If trees have souls, as one poet declares they have, how our patrician Sequoia must have lamented at this sacrilege. Some of the men who were cutting the trees boasted that their ancestors had crossed the channel with William the Conqueror. How the proud Sequoias must have scornfully exclaimed "Upstarts!" For the Sequoia's ancestors, hundreds of thousands of years before, had held a forest empire stretching from the icebergs of far northern Spitzbergen and from Greenland's glaciers to New Zealand, almost the last stopping place before the South Pole. The Sequoia race knew the days of the saber-tooth tiger, knew when camels roamed California, knew when peacocks were wild here. No one could boast to them of ancient lineage.

There are people in every country in the world who respect this ancient race, who look forward to the day when they can pilgrimage to worship at the feet of these, our Earth's last race of giants. They know that coming generations of men innumerable should be able to find rest and relaxation along the rivers and in the mountains under these monarchs. There is one thing that they do not know—that some of the finest and most accessible groves of these trees are being cut down to make grape stakes and railroad ties.

The Humboldt County State Highway extension traverses some of the most representative redwood groves. These, though neither so old nor so large as the Sierran Big Tree, are still the princes, if not the kings, of trees. Lumber companies own these groves. Thousands of automobile parties will soon know the way to this wonderland. They should be enjoyed by our grandchildren's grandchildren.

It is our generation's job to save them for posterity. There is being aroused, therefore, a nation-wide feeling of responsibility. The "Save the Redwoods League" has asked the California Nature Study League to tell this story to its thousands of correspondent centers. Additional information may be secured from its headquarters. Address "Save the Redwood League Library Bldg., University of California, Berkeley, California."

PENNSYLVANIA

Erie. Miss Flora Hallinan, teacher of nature-study in the grades at the Perry School, has original ideas in visualizing nature-study and in creating interest in observation and reading. Her pupils give illustrated little talks on birds, wild flowers, and animals. For this they make their own slides for the picture machine. Their equipment consists of the card board backs of paper tablets, scissors, paste and pictures cut from Audubon Leaflets, magazines, and catalogues. The pupils vie with one another in bringing pictures and reading matter, and in getting up the best talk with illustrations. One worked up a very interesting account of Poison Ivy and the Virginia Creeper. After a lesson on birds in which the Victrola gives imitations of bird songs, and their own beloved pictures float across the screen, it is not very hard to maintain a lively interest in birds. This was recently shown by their eagerness to become members of the National Audubon society. Of the 714 pupils in the school 610 are anxious members.

Erie. A nature-study department was added last winter to the many departments of the Woman's Club of Erie. It had already been organized, when Dr. Schmucker's lecture on "The Spirit of the Nature-Lover" gave great impetus to its beginning. Now there seem to be a large number of club women who are anxious to know birds and wild flowers, trees and stars. They come faithfully to meetings at 3 P. M. and go on excursions in small groups. Many of them are reading Mrs. Comstock's Handbook of Nature-Study with diligence and all are looking forward to a delightful year.

RHODE ISLAND

Providence. At the Rhode Island Normal School a conference on Nature-Study was held, Saturday, May 1st. Professor William G. Vinal was in charge and the program consisted of the Report of the Rhode Island Committee on Nature Study preceded by an address by Mrs. Comstock on the subject "What nature-study should do for the child and for the teacher."

The Normal School is holding weekly field trips to which everyone is invited. The places read like interesting spots: Swan Point May 5th; Metcalf Garden and Cat Swamp May 12th; Neutaconkanut Hill May 19th; Arcade Woods May 26th; Quinsnicket Woods June 2d; and Silver Spring June 9th. The trips are in charge of Mr. Vinal and Dr. Weston.

The Normal School has recently issued a convenient form of Winter Tree List which must be invaluable for rapid identification of trees.

In view of the multiplicity of nature-study activities of the Normal School it is not strange that it receives many requests for nature-study teachers and camp councilors.

Rhode Island Field Naturalists Club

We consider this club an inspiring example of what a carefully prepared program may do for a nature club. To read its program is to imagine yourself among a number of very congenial friends enjoying the excursions. We print the program for 1919–20 with the hope that there may be more Field Naturalist Clubs.—*Editor.*

Field Naturalist Club

October 11—If you cannot go to Quonocontaug and would like to go for a short trip Saturday afternoon meet at west tunnel entrance at 1:15 P. M. Leader and destination will be decided upon at that time.

October 18—Mr. Chase will lead the trip scheduled for Nov. 15. Chalkstone Avenue to Fruit Hill.

November 15—Prof. Brown will lead the trip scheduled for Oct. 18. Lime Rock.

What is Your Hobby?

If you have no special hobby wouldn't you like to interest yourself in one of the following: Shells, Seaweeds, Mosses, Lichens, Ferns, Providence Street Trees, Tree Diseases, Photographs of Earth Forms, Rhode Island Soils? Prof. Brown is offering a prize for the best photograph illsutrating land forms.

The Executive Committee will appreciate any answer you may care to make to this question.

RHODE ISLAND FIELD NATURALISTS

ANNOUNCEMENTS for DECEMBER

Informal Saturday Trips

Appreciate the beauty of the woods in WINTER.

Learn the joy of tramping in Cold Weather.

Last winter the club enjoyed Skating Parties, Bacon Bats and Hot Dog Roasts. Why not this season?

Meet at Exchange Place Waiting Station at 1:15 on Saturday afternoons. The assembled group will decide upon the destination.

A Trip to the Weather Bureau

Meet at the U. S. Weather Bureau Office, Room 1512 Turks Head Building, Monday evening, December 29, 1920 at 8:00 P. M.

"Explanation of Weather Bureau Instruments and Weather Maps" by Mr. H. Emerson Meyer, one of our new members.

Seashore Hobbies

Round Table Discussion of Seaweeds and Shells at the Rhode Island Normal School, Tuesday afternoon, December 9, 1920 at 3:30 P. M.

Exhibits of mounted Seaweeds will be shown by various members of the Club. A short talk on "Some Interesting Facts about Seaweeds."

Exhibits of shells will also be shown. Mr. William G. Vinal will speak on "Shells as a Hobby."

Your Executive Committee will welcome suggestions for the winter activities and also for the Spring Program.

JANUARY ANNOUNCEMENTS

More About Hobbies

January 6, Tuesday—Rhode Island Normal School. 4:00 o'clock.

"Sea Weeds, a Hobby for Forty Years." Mr. X. D. Tingley.

"Tree Diseases Collecting in Roger Williams Park." Miss Marjorie W. Stone.

"A Treasured Gift." Miss Lila Hurley.

"A Nature Study Hobby in the 5th grade." Miss Veronica Holland.

Miss Stone will also give a demonstration of the new method of mounting herbarium specimens now in use at the Park Museum.

January 24, Saturday—Providence Public Library. 8:00 o'clock.

"Camouflage Among Animals." Mr. Henry E. Childs.

January 27, Tuesday—Ladd Observatory. 8:00 o'clock.

"An Evening with the New Moon." Prof. Clinton H. Currier.

Should Tuesday evening prove cloudy Prof. Currier will be at the observatory on Wednesday; if cloudy on Wednesday evening, on Thursday; if cloudy Thursday, indefinitely postponed. If in doubt call Angell 1263-W.

RHODE ISLAND FIELD NATURALISTS

FEBRUARY-MARCH ANNOUNCEMENTS

Election of Officers

Saturday, February 28—Election of Officers, 3:00 o'clock. Arnold Biological Laboratory.

Social Postponed

Saturday, March 13—Annual Social at the home of Mrs. H. F. Morlock, 24 Linden Street at 8:00 o'clock.

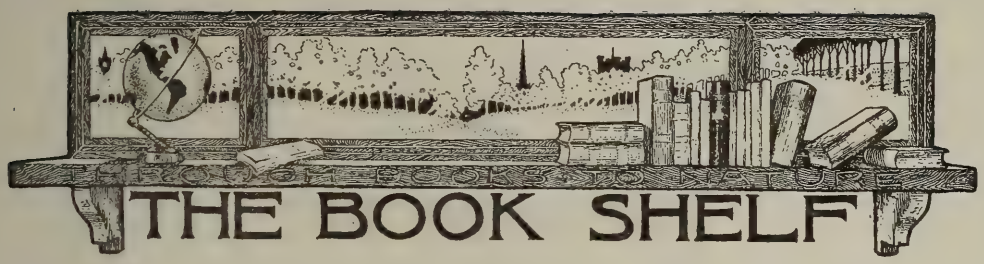
Existing conditions of illness and travel have made it necessary to make this change in date.

Round Table Conferences

Tuesday, February 24—R. I. Normal School, 3:30 o'clock.

"Rhode Island Ferns and Fern Allies of Today," Mr. Royal P. Richardson.

"Rhode Island Ferns and Fern Allies of the Coal Period," Dr. Marion D. Weston.



Studies in Science: Alice Jean Patterson, Teacher of Nature-Study and Elementary Science in Illinois State Normal University, Normal ,Ill., 480 pages, illustrated, Row, Peterson & Co.

Miss Patterson's work is well-known and is characterized by its breadth and thoroughness. Therefore this volume is of special interest to educators. The following announcements from its preface states well the use of the book: "This book is designed for the seventh and eighth grades of rural and village schools, and for the first book in science in Junior High Schools. Its purpose is to stimulate interest in the simple scientific problems found in daily life, to train toward a correct understanding and truthful interpretation of common objects and phenomena and to arouse some appreciation of the intimate relation that exists, on the one hand, between science and health, and, on the other, between science and economic prosperity."

This volume built upon Miss Patterson's teaching experience is full of practical suggestions and outlines; and the topics are dove-tailed together just as they are in Nature and this makes the work indicated a harmonious whole. It covers a course of two years and covers the following subjects:

First Year—Fall Studies: Plant Studies, Farm Crops, Weeds, Tree Studies.

Winter Studies: Soils, Water in Soil, Soil Water and Plants, The Work of Plants, Food and Health.

Spring Studies: Garden Studies and Home Projects, Farm Crops and Home Projects, Trees.

Second year—Fall Studies: Insects, Fungi, Yeast and Bacteria, Propagating Plants by Cuttings, Fruit and Fruit Trees, Domestic Animals.

Winter Studies: Light and Lighting, Water Supply, Forms of Water, Heat and Heating, Air, Weather.

Spring Studies: Poultry and Poultry Projects, Birds, Landscape Gardening.

The book contains many practical illustrations and we prophesy that it will have wide usefulness among enterprising teachers who cannot fail to appreciate its great value as a practical and usable course of study; and we cannot help but envy the youngsters who will be given a new outlook on life through it.

Conservation Reader: Harold W. Fairbanks, 216 pages, World Book Co.

The conservation of our natural resources will depend in the future, as now, upon public opinion; and public opinion, in order to act wisely, must be educated and it must be evident to every one that the school children of today must build up the public opinion tomorrow. Therefore it is our plain duty to get them to thinking about this great national question. Probably no one among our educators is better fitted to interest pupils in this subject than is Professor Fairbanks; and he has certainly written a conservation reader that is

as interesting as it is informing. The following are the headings of the reading lessons:

How our first ancestors lived; How our needs differ from those of the first man; The earth as it was before the coming of civilized men; Nature's unequal distribution of her gifts; The land of the poor people ; What the muddy rivulet has to say; How far will Nature restore her wasted gifts; The soil—the most important gift of Nature; Things of which soil is made; How the soil is made; How vegetation holds the soil; What happens where there is no protecting carpet of vegetation; The use and care of water; Could we get along without the trees? Where has Nature spread the forest? What are the enemies of the trees? How the forests are wasted? How the forests suffer from fires; Evils that follow the destruction of the forests; How our government is helping to save the forests; Our forest playgrounds; What is happening to the wild flowers? Nature's penalty for interfering with her arrangements; What shall we do when the coal oil and gas are gone? Need for protection of creatures that live in the water; Man more destructive than the other animals; What is happening to the animals and birds; The tragedies of Milady's hat and cape; The court of the animals and birds; The birds our good friends and pleasant companions; How to bring the wild creatures back again.

The book is made attractive by many pictures each of which tells its own story and there are also two colored plates one of the passenger pigeon already extinct and one of the sage grouse almost extinct; there are also several poems which are good literature and pertinent. Every child in America ought to personally possess this book; but as this is impossible it should be in the libraries of all the schools and of all the Boy Scouts and Camp Fire Girls.

Insects of Economic Importance. Glenn W. Herrick, Professor of Economic Entomology, Cornell University, 175pages, $2.25, MacMillan Co.

This is a terse and practical volume, dealing with remedies for the insect pests of orchard, small fruits, vegetables, hops, tobacco, cereal crops, clovers, cotton, stored grain, greenhouse plants, shade trees, farm animals, poultry and of the household. The first chapters of the book deal with: Losses caused by Insects, Useful Insects, Entomological literature, Natural Methods of Insect control, Artificial methods of insect control, Poison insecticides, Fumigating substances, Miscellaneous Means of Insect Control, Dusting, Quarantine and Insecticide laws.

In discussing the insects, there is first given an account of the habits of the insect and the nature of its injuries and then methods of controlling it.

Because of its brevity, clearness, thoroughness, up-to-dateness and reliability this volume is of great importance to teachers of gardening or to anyone who is a householder.

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OFFICIAL ORGAN OF THE

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A Canvasback

DECEMBER, 1920

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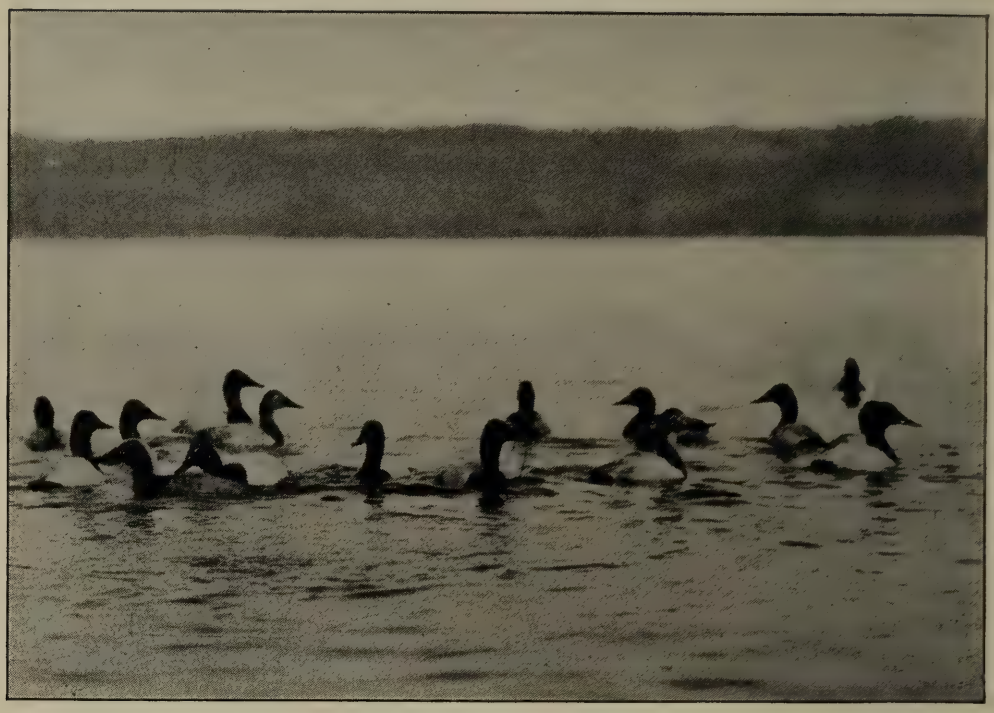

Photo by A. A. Allen

Canvasbacks on Cayuga Lake

TABLE OF CONTENTS

The Canvasback Duck. L. F. Brotherhood	363
The Ruffed Grouse. S. J. Wilkin	366
The Mallard. G. G. Wurzberger	369
The Woodcock. M. Jackson	371
The Sportsman's Creed	373
How to Study Game Birds	374
The Spotted Turtle. R. W. Shufeldt	380
An Eagle's Cunning. J. H. Ambruster	383
Common Snakes. E. B. Whiting	385
Anent a Hen. E. M. Provost	387
Bird Migration by White of Selbourne. C. I. Thomas	389
Unrest—Rest—Poems. L. A. Hausman	399
Notes on Birds Structure and Habits. J. Traver	400
Editorial	405
News Notes	407
Book Shelf	408

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THE
NATURE-STUDY REVIEW

VOL. 16 DECEMBER, 1920 NO. 9

The Canvasback Duck

LILLIAN F. BROTHERHOOD
Brooklyn, N. Y.

The canvasback duck is exclusively an American species. In the early part of the nineteenth century they were very plentiful along the shores of Chesapeake Bay. We can get some idea of their great numbers when we read some of the old records kept by the gunning clubs of that region. One of these records shows that in the season of 1846–47 one man shot seven thousand canvasback ducks, his greatest number for one day being one hundred and eighty-seven. It may be said here that the gunner had no trouble in disposing of his game for the epicures of both this country and of Europe created a great market for these birds whose flesh was thought by all to be the most palatable of all game birds. Indeed they must have been abundant in that region for some of the old slave contracts of that period contain provisions whereby the man hiring slaves from another man had to agree not to feed those slaves canvasback ducks more than twice a week.

Being entirely without protection and facing such wholesale slaughter it is no wonder to us that these birds have become scarce even in that part of the country where formerly they were most numerous. It is interesting as well as appalling to note the figures in the latter records as for the season of 1880 when six hundred and sixty-five canvasbacks were shot, and in 1901 in the same club only one canvasback was shot during the whole season. All of us know what it means when we compare the figures of 1846–47 with those of 1880 and 1901. However this situation is not as bad as it seems for in the last few years the number of canvasbacks seen in western New York and westward have shown an increase over those seen in the early part of this century. This increase may be due to the protection given them on their breeding grounds in Canada.

Name and Recognition Characters

The scientific name of the canvasback is *Marila vallisineria* named after *Vallisineria spiralis*, wild celery, upon which it feeds. Besides being known as the canvasback this duck has been called "white back," "bullneck." and in the vicinity of New Orleans "canard cheval or horse duck."

This species is often mistaken for the redhead to which it bears a resemblance. Therefore in learning to distinguish it from the redhead we will also learn its most characteristic marks. The males can be told apart as follows: 1. The chin and crown of the canvasback has a blackish tinge while the same parts of the redhead are like the rest of his head, rufus. 2. The lower back and the wing coverts of the canvasback are finely barred with wavy lines of black and white the black and white lines being of different widths, the white ones wider. On the redhead the lines are the same width. 3. The bill of the canvasback is over two inches long and that of the redhead is under two inches. 4. The head and neck of the canvasback are more brown than red whereas the same parts of the redhead are red. The female canvasback has a grayish brown back barred with wavy white lines. These lines are absent in the case of the redhead.

Range and Breeding Habits

The canvasback is found generally throughout North America. It breeds in the central British Columbia, Fort Yukon, south west Keewatin south to Oregon, northern Nevada, Colorado, Nebraska, and southern Minnesota. Breeding early in the season, nesting in the latter part of June, it associates with the scaups, the redheads, and the ruddy ducks. The nests are large and bulky, built upon a mass of reeds which is usually surrounded by water about knee deep. The nest itself is made of dead weeds, measuring eighteen inches by twenty inches outside diameter and the rim is built up about six inches from the water. The inner cavity is about four inches deep, lined with small pieces of dead reed and gray down taken from the breast of the female bird. The whole is so well concelaed as to be invisible from the outside. The eggs six to ten in a nest vary in color from grayish olive to greenish drab. Often the eggs of the redhead are found in the nest of the canvasback.

Migration and Feeding

Broods of the young birds collect into a vast army when the coming of the Arctic night tells them it is time to be on wing in search of a milder clime. With a roar of wings the feathered host rises into the air with a few old experienced birds to captain it. Little do they know what their leaders could tell them about the tricks of man. So, ignorant of what is before them, they proceed on their southern flight. Thus we see them in the United States during their fall migration, flying swiftly, one hundred miles an hour, in a straight line and maintaining a V-shaped formation.

The canvasbacks belong to the group of ducks known as divers because of their method of procuring food. They dive to the bottom of the water using their wings to propel them as in flying, and their feet as a rudder to steer them. Their chief diet consists of the roots of the wild celery. It is when the duck has been feeding on this plant that its flesh is so very delicious. In fact, when the canvasback has been feeding on mollusks, insects, pond weed and the like its flesh is no better eating than that of the mallard or the redhead. It has been proven also that domestic ducks or mallards fed on wild celery will deceive almost any epicure into believing he is feasting upon canvasback.

The Future

In the realm of sport the canvasback is an admirable game bird because being fearless, it is easy to decoy. Its ability to take to wing and to attain full flight quickly furnishes no end of thrills for the gunner. Fundamentally a game bird by habit and its inherent characteristics, the canvasback will always be hunted. And with so many sportsmen hunting it, its numbers will decrease, the sole survivors will be driven ultimately to seeking out the remote regions for nesting and migrating in an endeavor to propagate and preserve the species. The seemingly inevitable can be avoided only by careful observance of our present game laws.

"Saw a duck in the river; different kind from the last."
—*Thoreau's Journal.*

The Ruffed Grouse

Sidney J. Wilkin
Brockport, N. Y.

The ruffed grouse, or as the Romans would say, *Bonasa umbellus* is one of the best known game birds of this country. It has numerous names depending on what part of the country we happen to be in. In the British Provinces it is called the birch partridge; in the Northern Atlantic States, the partridge, while it is commonly called the pheasant in Virginia and more southern states. It is found throughout the Union from Massachusetts to Georgia and westward in the wooded regions of Ohio, Michigan, Wisconsin and Minnesota to the Dakotas. In the Southeastern States it is confined mainly to the mountainous parts, rarely descending to the valleys or low country. It is a permanent but roving resident.

This bird is from sixteen to eighteen inches long. The upper parts of the male bird are chestnut colored, varied with grayish and yellowish brown. The head is slightly crested. The bill is short and horn colored. There is a tuft of glossy, greenish black feathers tipped with light brown on each side of the neck. The tail is long and spread fan-like, and is yellowish brown, grey or buff colored with a broad subterminal band of black between the grey bands. The throat and breast are buff, the former unmarked. Underneath, the feathers are of whitish color, barred with brown strongly on the sides, less distinctly on the breast and below. The legs are feathered to the heel.

Its habits are well known to bird lovers and bird hunters. Its nature is wary and cunning to the highest degree. It inhabits dense thickets, swamps and clumps of bushes, but prefers a hilly or mountainous country covered with timber. Very often it is found along the banks of streams which are covered with bushes. The most characteristic trait of these birds is the drumming of the male. The male drums throughout the year, but most frequently in the spring during the mating season. In the spring it is a defiance to his rivals or a call to the hens. The rest of the year it signifies the bird's general good health and lusty vigor. The drumming sounds like the low muffled roll of a drum and is made solely by the wings. However, there is considerable contention as to just how the sound is produced. Some believe the wings are struck together over its back, others believe it strikes the log or rail

on which it stands, still others believe the drumming is made by the wings striking the sides of the bird. A more recent theory and probably the correct one is that the sound is made only by the rapid vibrations of the wings.

The cock mounts on his particular log, puffs out his feathers until he is twice natural size and then struts up and down very much like a turkey. Then he throws his body forward, stretches out his neck and commences to beat the air with his wings. The beats are rather slow at first, then quicken, growing faster and faster until the wings disappear entirely and only a blur is left to the eye. The muffled tone, low at first swells with the increased rapidity of the beats until a loud solemn roll is borne thorugh the neighboring woods.

When flushed, the grouse reveals its cunning and ability to take care of itself. It rises with a tremendous whir which can be heard for a long distance and is extremely disconcerting to the inexperienced hunter. Its flight is extremely swift and powerful. As a rule it makes a zigzag course until it can place a tree or bush between itself and the hunter. A flock of grouse will never all rise at once. Usually two will go up at first and then one at a time after that.

Along about the latter part of April, the female or hen grouse will slip off quietly and make her nest. Not much care is taken to build the nest as it is merely a hollow scratched in the ground and lined with grass, leaves, needles from the pine tree and similar materials. However, the lack of pains taken in making the nest is more than made up for in the care with which it is concealed. Usually it is beneath some bush or log, or in a dense thicket alongside some overhanging rock or in the tangled top of some fallen tree. If one has the good luck to run across a nest he will find nine or ten eggs of varying shades of buff, dotted with different sized spots of pale reddish brown. The hen is a very close sitter and never goes away except when in imminent danger and then returns to the nest often at great danger to herself. One day, a year ago last spring, I was working on a fence around a ten acre wood lot and I accidentally found a nest, eggs, bird and all. I had gone a short distance into the woods to get a rail which was resting against a tree. When I started back I just missed stepping directly into the nest. The eggs were warm and I knew the bird had not been off the nest long. As I returned to the fence I kept

one eye on the nest, and sure enough, before I had gone twenty feet I saw the hen slip back on to the nest.

Incubation starts about the first of May and lasts generally from three to four weeks. At the end of this time the hen will walk about followed by seven or eight little brown tufts of fuzz. The mother rears them much the same as our domestic fowl raises her brood. She teaches them to eat insects and worms and at night hovers them under her wings. When in danger, a shrill note from the hen will send them all scurrying to cover. They will skillfully hide under any favorable object or squat and remain motionless, harmonizing so well with the color of the ground and dead leaves that it is impossible to distinguish them. When they are half grown they roost on trees.

The adults feed on berries, various nuts, acorns, wild grapes and the like. Crickets, grasshoppers, larvae of caterpillars and strawberries are considered dainties. When these fail, they eat the foliage of many plants such as wintergreen, buttercups, partridge berries. In winter they eat the buds of apple, birch and other trees. The flesh is white and tender, but in late fall or winter sometimes becomes very bitter and sometimes quite poisonous to many persons on account of the bird feeding on leaves of alder.

The birds mate in late April, but after the breeding season is over the males keep apart, joining coveys as winter sets in. They bear the winter well, due no doubt, to the heavy winter coat of feathers carried down to the heel. The birds often dive headlong into a snow drift towards night and remain warm and snug, flying out in the morning. Unfortunately crusts are sometimes formed over the drift during the night and the birds are imprisoned. They often die of hunger unless a thaw sets in suddenly or they get out in some other way.

The ruffed grouse is one of America's greatest game birds. Even most skilled sportsmen armed with the latest bird guns and with the best trained dogs often come home with light bags giving proof of their cunning and cleverness. Mr. G. O. Shields says, "The ruffed grouse, by reason of its sudden burst from cover, its bold, strong, swift flight, the rugged nature of its favorite cover, its proud, erect carriage, its handsome garb and its wide distribution is easily the king of American game birds, and has therefore been chosen as the emblem of the league of American sportsmen."

Photo by A. A. Allen

A Pair of Wild Mallards

The Mallard Duck

GEORGE G. WURZBURGER
San Francisco, Calif.

When the ice begins to form on the Northern lakes and rivers and the wind sweeps the seeds of wild rice and lotus from their retaining pods, the mallard duck takes to wing and migrates south to where the small, grassy ponds and rivers, thickly grown with wild rice and rushes yield adequate food and shelter. Without a doubt, the mallard duck ranks among the first of the duck family as its great pluck and gaminess make it well beloved by the duck hunter; and from the standpoint of the epicurean, it is the acme of ducks for the table. It is not as gaudy in color as the wood duck, its close relative, but when cruising quietly over the water or pruning its feathers on the shore, lit up by the setting sun before retiring into the rushes for the night, the drakes head and neck glassy green with white ring-like collar defining the dividing line from the rich chestnut breast, body grayish white finely marked with brown and purple make it one of the handsomest and most aristocratic birds I know.

The mallard is a mixed feeder. When the grain is plentiful among the stubble after the farmer has removed his crop, the ducks

will leave their roosting places in the ponds early in the morning and go to the fields where they feed until satisfied or tired, when they betake themselves to the water to probe the muddy bottoms for small mollusks, fish worms and rootlets of water plants. Corn, when ripe is another favorite cereal of the mallard and I have seen them climb upon the shocks of corn standing in the fields in order to feast upon the ears. Unlike other ducks which become indolent and lazy after a plentiful dinner, the mallard becomes very lively, exercising, diving and spattering the water, half flying and running along the surface of the pond.

In early spring we can hear the cheerful calling of the mallards as they go north to their nesting grounds, passing through the same air lanes year after year. Upon reaching the breeding grounds the mating commences. It is worth while to observe the courtship of the drake. I have watched them on the Klamath Lake in Oregon where mallards nest in great numbers, and where the flag covered shores afford a great opportunity to study these birds in their native and unmolested haunts. Never was there a more courteous or gallant courting. Mallards are strictly monogamous and remain paired for life. One would naturally expect that such an ardent lover as the drake would also make a good father but, after the mating season, he becomes indifferent and does not assist the female in nesting or raising of the ducklings. The female however is the best of mothers, leaving her nest with six to a dozen eggs only when hunger drives her in search of food; and even before leaving, she carefully pulls down the surrounding cover so as to protect her greenish gray treasures from the vision of possible enemies.

Mallards are very plentiful and are widely distributed. They are the best known wild ducks as they are the ancestors of one of our domesticated species. Their tendency to flock together and to come to decoys, either of wood or captives used for this purpose, cause many mallards to be killed yearly by hunters. Aside from man, the mallard also has natural enemies. The large water rats and pike do the greatest damage to the ducklings; while the fast flying duck hawks find them easy prey, overtaking them and while in air sinking their needle-sharp talons into the tender portions of the mallard anatomy.

The Woodcock

Mildred Jackson
West Danby, N. Y.

One of our best known birds among the sportsman and least known to the casual observer is the American woodcock. Both its appearance and habits are so unusual among the bird world that it deserves particular attention. The coloration of this bird is so wonderfully protective that it is almost impossible to locate it unless it is started from its haunt. The front of the crown is slaty, washed with buff, an indistinct blackish line in its center and another from eye to bill; the back of the head is black with bars of ochraceous buff; the rest of its upper parts are black, margined with slaty and barred and mottled with rufous or ochraceous buff; tip of tail ashy gray above, silvery beneath; underparts between ochraceous buff and rufous; the other three primaries are very narrow and stiffened.

The male bird is from ten to eleven inches in length and the female about an inch longer. Its range is eastern North America from Canada to the Gulf. It winters south of Virginia but is here a summer resident from February 19th to December 2d. The casual observer would at once note its stocky body, short, stout legs, long, straight, and stout bill and the large eyes on top of its head.

If we wish to see this bird during the early summer we had better visit the bogs and damp woodlands. Here the moist earth make it comparatively easy for the strong bill to probe for its entire length to the nostril into the soil for earthworms. These are located entirely by the sense of touch, for the eyes are too far back on its head to aid in this; they are continually watching for the enemy. With such eyes there seems little room for brains but Dr. Cowes says, "If the brain be examined, it will be found curiously tilted over so that its anatomical base looks forward. They are knowing birds if their brains are upset and their successful pursuit calls into action all the better qualities of a true sportsman."

The upper mandible is longer than the lower mandible, the tip being very sensitive and flexible. It may be moved entirely at will independently of the other; it finds the worm and works it into the mouth as if it were a finger. A group of small round holes in moist soil always denotes the presence of woodcock. Most of their feeding is done at night when the worms come to the surface.

Early in the spring the male bird begins to feel the desire for a mate, and he expresses this in the most original manner. At evening he stands with his bill downward, his body inclined forward and calls, "pink, pink", then he springs from the ground and circles round and round, each circle overlapping the one before it, until the spiral may be three hundred feet from the ground. Then he utters a sharp whistle and pitches down again, alighting in very nearly the same place from whence he started. If the mate is actually there, he may dance little jigs before her. These performances are continued frequently during the mating and nesting season, but the little lady often appears coldly indifferent to her lover's madness. The gladness of the woodcock is voiced by the rush of air through the narrow and stiffened primaries as he drops from a height in the air. It is a strangely beautiful sound and has been beautifully expressed:

"Peent-peent-peent-peent
From the thick grass on the hill,
Peent-peent-peent-peent
At eve when the world is still
Then a sudden whistle of whirring wings
A rush to the upper air
And a rain of maddening music falls
From the whole sky—everywhere."

What we term the woodcock's nest is only a clump of dried leaves on the ground. It is usually situated in the woods near a stump. Here are laid four buffy eggs spotted with reddish brown. They have often been found before the April snows have melted. Mother woodcock will not desert her eggs and will allow a person to pick her bodily from the nest rather than leave it at this time. The little chicks are active, fluffy babies. Almost immediately after hatching, if the mother utters a warning, they are able to disappear. Sometimes she carries them between her thighs to a different feeding ground where they follow again her careful leading.

About the first of August, these wood folk separate to visit the corn fields, grassy meadows, birch groves and alder runs. Here they moult and are easy mark for the hunter especially as a small flock often congregate together. Their wings no longer whistle and will scarcely lift the heavy body from the ground.

Early frost, freezing the ground so that they are unable to obtain food, sends them migrating southward. Now we find the bird a skilled flier, much different from the mother who attempted to lure the hunter from her baby chicks by feigning lameness. Many are killed each year by flying against telephone and telegraph wires.

The woodcock appears in New York state as early as Febraury 22d but usually from March 10th to March 15th. They are a summer resident of this section. So many have been killed by cats and hunters or driven away by the drainage of swamps and destruction of their favorite coverts that our once plentiful bird is fast disappearing.

AMERICAN GAME PROTECTIVE ASSOCIATION

Woolworth Building, New York City

THE SPORTSMAN'S CREED

(Abbreviated)

I believe that a sportsman should

1. Never in sport endanger human life.
2. Never kill wantonly or needlessly or brutally.
3. Obey the laws of State and Nation, work for better laws, and uphold the law-enforcing authorities.
4. Respect the rights of farmers and property owners, and also their feelings.
5. Always leave seed birds and game in covers.
6. Never be a fish-hog.
7. Discourage the killing of game for commercial purposes by refusing to purchase trophies.
8. Study and record the natural history of game species in the interest of science.
9. Love Nature and its denizens and *be a gentleman.*

Photo by S. J. Wigley

Canada Geese Feeding in a Green Field

How to Study the Game Birds

Probably no other phase of conservation is more important than that of protecting those birds and animals, hunted from earliest times because of their value as food. The hunters have seen many species become extinct before the muzzles of their thousands of guns and, learning wisdom before it is entirely too late, they have made laws to prevent the extermination of those species that still persist. No more important work can be given to pupils in seventh and eighth grades and junior high school than the attaining of knowledge of these creatures and the laws which protect them. Such study widens the pupils intelligence and interests and also makes for good citizenship and obedience to law.

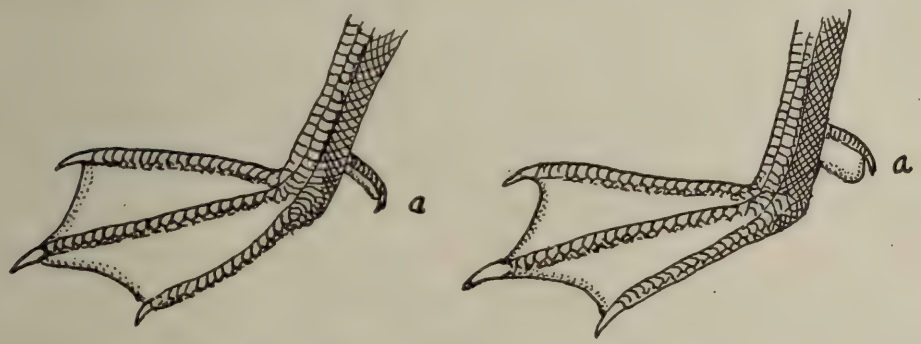
The Most Common Game Birds

These belong chiefly to three orders of birds, the ducks and geese, the shore birds and the scratching birds.

Wild Ducks

The ducks are separated into two subfamilies, the River and Pond Ducks and the Bay and Sea Ducks which are distinguished from each other by the simple structural character that the former

lacks the lobe on the hind toe which is present in the latter. The River and Pond Ducks not only lack this flap on the hind toe, but their feet are not so powerful as oars, being smaller and with webs not so fully developed; and their legs are placed farther forward than in the other subfamily. They live in protected, calm and shallow waters; they do not dive like the fishing ducks but dabble with their bills along the surface of the water for small aquatic animals or, tipping the tail in the air like our domestic ducks, they hunt the mud or water weeds for mollusks or insects or for the leaves and roots of aquatic plants. Their bills are long and flat and well fitted for this kind of fishing and have strainers along the sides so as to retain what they get and let the water escape. The drakes are much more brilliant in plumage than the ducks; during the summer the drakes are clad in "eclipse" plumage which resem-



Foot of River and Pond Duck Foot of Sea and Bay Duck

Hind toes shown at *a-a*

bles that of the ducks. The young of both sexes resemble the mother in color. The following is a list of the River and Pond Ducks:

Mallard, Black, Gadwall, Baldpate or Widgeon, Green-winged Teal, Blue-winged Teal, Shoveler, Pin-tail and Wood Duck.

The Bay and Sea Ducks have a lobe hanging free on the hind toe. The feet are larger and the legs are shorter and placed farther back than those of the Pond and River ducks; thus they act far more powerfully as oars. These ducks are all strong swimmers and divers; they often seek for their food seventy-five or even one hundred and fifty feet below the surface of the water. Some of them live largely upon mollusks and other aquatic animals and use but little vegetable food and therefore their flesh is coarse and unpalatable. However, some of them like the canvasback, are

considered great delicacies. They often occur in great flocks on their feeding grounds. They have bills shorter and deeper at the base than those of the Pond ducks. The drakes are not much more brightly colored than the ducks; in fact they are rather sober colored birds. There are fifty or more species but the following are the ones most commonly hunted:

Red-head, Canvasback, Greater Scaup or Broadbill or Bluebill, Golden Eye or Whistler, Buffle Head or Butter-ball, American Eider, American Scoter, or Black Coot and the Ruddy Duck.

Wild Geese

Wild geese feed upon vegetable matter and live upon the land far more than do the ducks. The sexes have similar plumage and the ganders are devoted to their mates and young. There are several species of wild geese in the United States:

The White-fronted, the Greater and Lesser Snow, the Blue, the Barnacle, the Canada, the Brant and the Black Brant. Of these only the Canada and the Brant occur in sufficient numbers as to be familiar to hunters.

The Shore Birds

Although there are many birds belonging to this Order that are shot and eaten, yet the most common game shore birds are the Snipe, some of the Sandpipers and the Plovers and Woodcock.

The Gallinules or Scratchers

Among the birds of this order are some of the most prized game birds of America. They are:

The Wild Turkey, the Ruffed Grouse, the Bobwhite, the Prairie Chicken, and the European Pheasant.

How to get to Know the Game Birds

First of all comes the recognition of the bird, and this is best gained by coloring an outline which the pupil may make for himself or obtain ready for water colors. This is a very important part of the work since it fixes in the mind the distinctions between these seldom seen birds. A set of game birds pictures may be used

to decorate a room or they may be put in a portfolio together with the accounts written according to the outline given below and which would prove a valuable asset to any pupil or teacher. The Bird Book published by the *Geographic Magazine* at Washington, D. C., or the Bird Plates published by the State Museum at Albany N. Y., will give the colors to be copied by the pupils. The Reed Bird Guides also have colored pictures of these birds.

An Outline for the Study of Game Birds

The answers to the following questions should be ascertained as far as practicable, and the facts thus gathered should be arranged and written up to make a coherent account or story of the habits and peculiarities of the bird.

1. Does this bird occur in your State?
2. If so, is it a permanent, a winter or summer or a transient resident?
3. If it occurs as a migrant, at what season is it seen?
4. Is it usually seen in company with other birds, or alone?
5. Consult the bird manuals and tell all that you can find concerning its winter habits; if it migrates, what are the limits of its journeys north and south?
6. Where and at what time of year does it nest? Describe its nest, eggs, and its care of its young.
7. What colors, markings or peculiarities of flight distinguish it when on the wing?
8. How can you identify it when at rest?
9. Upon what does it feed and where does it find its food?
10. Is it of economic importance, if so, how and why?
11. What are its natural enemies?
12. What are the game laws in your State for protecting this bird? Should it be more strictly protected, if so, why?

In this scheme of study the game laws play a very important part. Copies of the game laws of any state may be obtained free of charge by writing to the State Game Warden at the capitol. The game laws of the United States for 1920 have been published as Farmers Bulletin No. 1138, The United States Department of Agriculture, Washington, D. C., and may be obtained free of charge. Both of these should be in the library of every school.

To illustrate the kind of story about a bird based upon the above outline is the following account of the Canada Goose.

The Canada Goose

To most of us this bird is the wild goose that we see in V-shaped flocks moving swiftly through autumnal skies, the "honking" of the leader at the head of the wedge and the shrill response of his followers, stirring our blood and in some strange manner uplifting the spirit. We, in central New York, seldom see one of these birds alone or with its mate for it is not a permanent resident with us. Its migration southward takes place from October to early December but in our minds is associated with November when we regard the passing of a flock as a harbinger of colder weather. "A snowstorm follows the wild geese from the north" say the country folk. The spring migration may take place from late February to early May but usually occurs about the first of April and is regarded as a promise of spring.

Those geese that nest in Newfoundland and near the north Atlantic coast migrate along the coast, rarely out of sight of land; but those that nest inland migrate by other routes, resting on large bodies of water safe from hunters. These geese winter in the southern half of the United States and they nest as far north as the forests extend in the lower Yukon, in N. W. Mackenzie and Central Keewatin to Southern Oregon, Northern Colorado, Nebraska and even in Indiana in the West,—and in the East—in the Hudson Bay region, Labrador and Newfoundland.

Whenever we eat Meunier's chocolate we should think gratefully of the elder Meunier who rescued the island of Anticosti in the mouth of the St. Lawrence from squatters and pot hunters and has kept it as a bird preserve. On this island the Canada geese breed as do many other species of water fowl, and the number of geese moving along the Massachusetts Coast has increased since this refuge was established.

The Canada goose builds its nest on the ground, preferably in a marsh on some island or islet; it is made of twigs, grasses, reeds and a large amount of down, probably plucked by the mother from her own breast; the eggs are from four to seven in number and greenish white in color. The parents are very devoted to each other and together care solicitously for their goslings. The gander is a valiant fighter and is very brave in protecting his nest and family from their enemies which are largely otters, fishers, mink and other predatory animals that haunt the marshes. The goslings, as soon as their down is dry after hatching, go with their

parents in search of food. A delightful account of the care of the goslings by their parents is given by J. G. Long in *Northern Trails* under the title of "Quaptonk the Wild."

The food of the Canada geese consists chiefly of unharvested grain and blades of winter wheat during the migration; they also feed upon the seeds, roots of plants and small animals found in the flooded marshes; and upon eel grass which they get by thrusting the head down into the water; they also eat quantities of sand to aid digestion. They go to their feeding grounds early in the morning and late in the afternoon. In California the geese do much damage to the wheat fields, but in the East they do little harm.

The special mark of the Canada goose is the white patch on the throat that extends up on the cheeks, looking as if it had "a bandaged sore throat." The head and neck are black, the back and wings brown, the underparts ashy gray, and the under tail coverts white. The body feathers are edged with paler colors; the bill and feet are black. The wedge-shape of the flying flock is the special character that distinguishes these geese when in flight. When resting, their large size, black heads and necks and white cheek patches tell us unmistakably what they are.

The open season in New York State for these geese is from September 16 until December 31. The hunting licenses for residents cost $1.10 and for non-residents and aliens $10.50. Hunting is prohibited on public highways and on any lands supplying towns with water. The bag limit is eight geese. On Long Island the law is somewhat different. The open season is from October 16 to January 31. With these laws enacted and because of the wariness of the geese, there is probably a not too great number killed each season to endanger the species. However, probably the laws along the Atlantic Coast should be more stringent than they are at present. These splendid birds should be safely preserved for centuries to come, for America would not seem like America without the wild goose to "drag its harrow" across the gray skies of our Novembers.

Honk! Honk! On stormy wings they cleave the upper air,
On gusty breeze, above the seas—their onward cohorts fare;
They come from frosty solitudes, where broods the Arctic night,
Where deserts grim, spread vast and dim, in the auroral light.

From "The Flight of the Canada Geese" by ISAAC MCCLELLAN.

The Spotted Turtle: Pond Turtle

Melanemys guttatus (Shuf.)

By Dr. R. W. Shufeldt

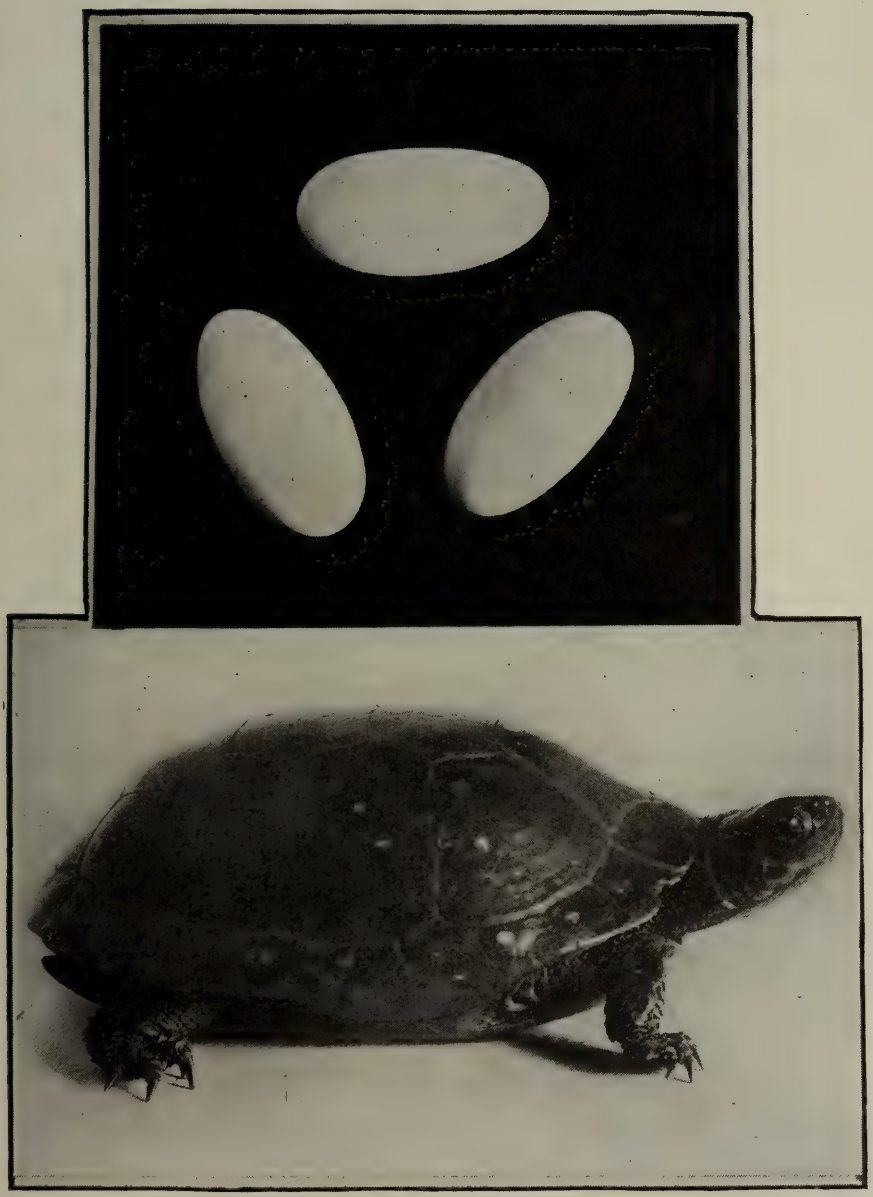
Formerly our well-known little Pond or Spotted Turtle, together with Muhlenberg's and the Western Pond Turtles, were arrayed with the Wood Terrapin of the northeastern United States in a genus *Chelopus*. Now the three first-named species are all aquatic by habit, while the Wood Terrapin is a terrestrial form, living in damp woods, and very rarely entering the water. Add to these facts the entirely different structure of these *black* pond turtles—as compared with the corresponding characters in *Chelopus insculptus*—and it should be evident to any herpetologist that we have here two genera instead of one. Convinced of this fact, the writer has, in another connection, suggested the name of *Melanemys* for a genus to contain the three pound turtles, while the Wood Terrapin may still be known as *Chelopus insculptus*.

Ever since the summer of 1865, the writer has, at different times, had in his possession living specimens of our familiar little Spotted Pond Turtle (*Melanemys guttatus*), and a very pretty female one is at hand at the present time. This individual was taken by a boy collector in Virginia in June, 1919, and on the tenth of the following month it laid a pure white, ellipsoidal egg. This was repeated on two subsequent dates—on the 24th and 26th of the same month. The turtle and the three eggs were soon thereafter photographed by the writer, and reproductions of the photographs are shown in the figure—the eggs being reduced one-fifth, and the turtle reduced somewhat more. Later, these three eggs were accepted by the United States National Museum for the collection in that institution.

Eggs of our pond turtles are found from time to time; but it is not easy to tell the species that laid them. In the present instance, however, the diagnosis is absolutely certain, as no other turtles were in the aquarium at the time they were found there on the above dates.

All turtles lay soft-shelled eggs, and those of some of the big marine species and a few other forms, are quite round in form.

Our Spotted Turtle has a smooth shell or *carapace*, flat below and rounded above, the outline being more or less elliptical or oval. No part of its borders are serrated or toothed, as we find them to be



The Spotted Pond Turtle and three of its eggs.
Photo by R. W. Shufeldt

in other fresh water species, such as in our common snapping turtle and others. Rarely does this species exceed four inches in length; and while the tail is pretty long in the males, that appendage is notably short in the opposite sex. Both males and females have the anterior extremity of the upper jaw notched, and a very moderate webbing of the four feet. Superiorly, the shell is black, and presents, scattered over it, more or fewer small, round, yellow spots. On the flat part of the shell below or on the plastron, the coloration and pattern varies considerably, the figure being generally black or blackish, with the yellowish, central figure varying in size and outline, and sometimes passing to almost a salmon or pink color.

With the exception of the head, the exposed soft parts are of a pinkish salmon color, sometimes blotched with blackish. The head is black above, spotted with yellow, with a conspicuous yellow or orange spot on either temporal region.

This beautiful and gentle little species ranges all over the New England States, southward to North Carolina and westward to Iowa. In some localities it is extremely abundant, and around Stamford, Connecticut, in the early 60's, it was by no means an unusual thing to take thirty or forty of them with a dip-net out of some small pond in that locality. The writer has counted as many as a dozen sunning themselves on some old log that projected above the water of such a pond, wherein many more of these turtles lived.

The young of this species are truly beautiful little creatures, and make fine additions to aquaria. They will eat tender lettuce leaves, raw meat scraped, angling worms, berries, and the like, and they have the power to go for several months without any food at all. One in the writer's possession at this time has not eaten a mouthful for over two months, yet it is as fat and as lively as any pond turtle that ever lived. After its fast it declined some tender lettuce, of which it is extremely fond.

It is said that this species invariably feeds under water, and is never known to take food above that element. Some authors state that it can not swallow unless the head is submerged when the reptile is feeding. There are many kinds of aquatic insects it preys upon; but if need be, it will also partake of dead fish. Probably, at least to some extent, this turtle is a vegetarian, and eats, at times, certain aquatic plants.

The writer does not recall ever having seen a specimen of the Western Pond Turtle (*M. marmoratus*), as it is a Pacific Coast species, and the pleasure of examining a live example of Muhlenberg's Turtle (*M. muhlenbergii*) has occurred but once, thus far, in his lifetime. Dr. Charles H. Townsend, Director of the New York Aquarium, gave him this opportunity, the specimen being a very beautiful Staten Island one, and in a tank in that institution. Muhlenberg's turtle is almost entirely black, being readily recognized by the brilliant orange spot on either side of the head, near the ear-opening. Still other characters distinguish it, as its high and elongate carapace, which is unspotted.

An Eagle's Cunning

J. H. AMBRUSTER
Peoria, Ill.

Upon a Colorado mountainside, Frank Smith, a gold miner, from his lonely cabin daily watched the majestic eagles soaring high in the air. Full of American pride he desired to possess one of these birds. The same pride, instinctive in all patriotic American citizens, would not countenance the killing of one of the emblems of the country—he wanted a live one. Accordingly he set a spring trap, baited with a delicate morsel, and patiently awaited developments.

While eagles were more or less plentiful in the vicinity, magpies were more so; in fact, they were so numerous as to be almost a nuisance. Before many minutes of waiting an elegant specimen of the American eagle appeared and perched himself upon a nearby jagged cliff. His searching eye apparently at once observed the bait, but before he had time to fully decide as to the next move, a bold magpie, who had also discovered the dainty dinner tidbit, hurriedly flew down to grab it. The trap was sprung and Mr. Magpie was a prisoner. In the twinkling of an eye the eagle swooped down upon the unfortunate bird, plucked him from his captivity, flew back to the cliff and feasted upon magpie. Then wiping his bill in his feathers, he assumed his former position as guardian of the trap, which in the meantime had been rebaited and reset.

Another magpie appeared, descended as did its mate, was caught, plucked from his imprisonment by the eagle, taken to the dining quarters on the mountain side and devoured. This procedure was again repeated and the third magpie was caught for the eagle's benefit, when the plan of trying to capture the eagle was abandoned for the day.

The next day the attempt was resumed with the same result for a time, the same eagle being in readiness to empty the trap as soon as a magpie was caught. Remaining magpies becoming suspicious and not so easily trapped as their unfortunate leaders, and the eagle on the contrary becoming more bold, the latter could not resist the temptation to inspect the trap when the magpies failed to be attracted by it, and finally the noble bird was in the clutches of the snare.

At last Frank was rewarded for his patience and long vigil, and proudly took the bird to his cabin. But now the question arose—what should he do with it? He had intended to build a cage but had neglected to do so in advance of the capture. To tether the bird with a piece of cord would only result in the eagle quickly picking the cord to pieces and thus freeing himself. Accordingly a piece of wire was fastened around the bird's leg and in this manner he was held captive. The wearing qualities of the wire had, however, not been taken into consideration and no provision had been made for a piece of cloth or other soft material between the wire and the leg; consequently, in a short time the wire wore into the flesh and bone, causing blood poisoning, and soon the bird was dead.

Frank, nevertheless, had a stuffed eagle to assist in telling the story of his adventure on the mountainside, even though he was not permitted to have the pleasure of a live souvenir.

The far-famed Canvasbacks at once we know,
Their broad, flat bodies wrapped in pencilled snow;
The burnished chestnut o'er their necks that shone,
Spread deep'ning round each breast a sable zone.

—ALEXANDER WILSON.

Common Snakes

E. B. Whiting
Branford, Ct.

During my walks in early spring when dry leaves are on the ground I have always taken an interest in snakes such as one meets in or near the woods. At this time of the year when the trees are bare and there come some really warm sunny days, snakes crawl out of their winter hiding places and sun themselves to drive off winter chills. They probably feel somewhat helpless at this time because there is little stubble or grass to make rapid gliding possible. Later in the season when the grass has begun to grow, they can move more rapidly and are better concealed from observation. It is then that the slower moving venomous snakes are more likely to be noticed.

There is one feature in the behavior of black snakes which some one has mentioned, but probably few have noticed. A black snake when it considers itself disturbed, will sometimes strike the crisp dry leaves on the ground with the tip of its tail, and make a rattling noise as if it tried to be a rattlesnake; yet it is plainly a common black snake, and entirely devoid of rattles.

Sometimes, if one catches up with a crawling black snake and strikes it with a switch, the sting of the switch will cause it to stop, and give one a chance to view it at close quarters. It can then be allowed to go on its way, or if we wish to capture the snake, we hold its head down with a stick while we grasp it close below the head to prevent its turning, and with the other hand we take the precaution to keep its body straight to prevent squirming. When a black snake is chased through bushes and low trees it will sometimes start up a small tree and circle about to face us a few feet above the ground, and wait to observe our further motions. While the snake is in this position a stick can be cut and a noosed string attached, and the snake will keep still as the stick and noose are thrust forward. During this noosing process our snake keeps a stiff neck, and it can then be pulled out of the tree. We will now have a problem to keep our catch from strangling itself by squirming around and twisting up the string; and we have to come to the rescue by cutting the string, keeping hold just behind its head, and keeping its body straightened out to prevent having a coil thrown around one's arm as a preliminary to getting away. The

black snake can bite rather hard, though said not to be poisonous. One can tree such a snake when on horse-back. The dash and clatter of the horse gives it a strong inclination to climb a bush or tree to get out of the tumult.

This species of snake can be made a pet, and any tendency to bite can be checked by taking one stitch each side of its mouth, and tying each stitch. This can be done almost painlessly, and the snake can then readily drink milk, and its forked tongue can be thrust out of its mouth. This tongue-play adds considerably to the awesome effect.

Of course, one has to be guarded in handling poisonous snakes, and it would be better not to take any risks. The common green grass-snakes and the small yellow and black striped snakes are regarded as non-poisonous. There is a black water-snake which on close observation appears mottled, and this snake might pass for the common black snake. These darkly mottled snakes are said to be poisonous. In case there are any fangs we will find them folded back against the upper jaw.

Once while driving through the woods, a queer looking snake appeared in the road. It made us think of some pictures of venemous East Indian snakes, because it had a remarkably large head. On investigation, it appeared that a common snake had attempted to swallow a frog, and the poor frog, as frogs will, had inflated its body while its legs had been swallowed. The snake was holding the inflated body high up to avoid obstructions and the combined effect was rather startling at first sight.

As an experiment a striped snake about two feet long was held extended between both hands and dropped from a bridge. As it struck the water a few feet below it appeared to be crippled, and turned over and over in a queer way for about a minute. We then saw that the snake had bitten onto itself at about the middle of its body. It soon let go its hold, however, and then swam off freely as if in perfect condition. Therefore the self-biting could not have had any serious effect.

A black snake over five feet long was captured and put into a roomy box with a glass cover. It would watch our motions and often strike upward at the glass. It prepared for these lunges by keeping its body in a close back-and-forth series of folds and there was a constant slight progressive motion through these folds. It did not form a true coil such as one sees pictured for a snake

From The Game Bird Outlines THE CANVASBACK DUCK (Copyrighted) Comstock Publishing Co.

From The Game Bird Outlines THE WOODCOCK (Copyrighted) Comstock Publishing Co.

From The Game Bird Outlines THE RUFFLED GROUSE (Copyrighted) Comstock Publishing Co.

ready to strike. This back-and-forth folding would seem a more natural way to keep a clear field open for making a lunge than would a coil of a circular form which would have to cross itself if the slight forward progressive motion were to be kept up preparatory to striking; or instead in this latter case there would need to be some side-slipping of the coils. It would be a matter for observation to note what really does take place with a coiled snake.

Anent a Hen

EVA MARAIN PROVOST
Brooklyn, N. Y.

Upon a crowded city avenue one day I chanced upon a little maid wheeling her doll carriage; on the front of her vehicle, suggestive of the bow of a vessel, sat that erstwhile considered stupid being—a hen—receiving, with enviable self-control, the smiles and comments of passing mortals. Later, I learned that Queen Bess had done "her bit" in Red Cross work, having performed at school, several tricks under the direction of her small mistress. Following is the little girl's own story of her pets:

QUEEN BESS AND HER FRIENDS

Doris Gandar Smith
Aged 12 years

I am going to tell you of my pet chicken. About three years ago, the night before my birthday, I went into the kitchen and heard "peep, peep, peep." You may imagine my surprise upon seeing a box and in it three baby chicks. When they were fully grown, they turned out to be two hens and a rooster. One of the hens I named Lady Smith, the other, Lady Gandar, the former for my own last name and the latter for my middle name. The rooster I named Reddy Spruce Columbus Smith. The two hens, White Rocks, had white legs. The only way that one could tell the difference between them was that Lady Smith had green eyes and Lady Gandar yellow eyes.

Reddy was a buff leghorn with tail feathers of a golden color. He never grew very much—as a rule, that type of rooster never does: also, he never weighed over two pounds. Every evening, just at five o'clock Reddy would knock at the kitchen window

with his beak and Mother would let him in. Once not being able to make himself heard he jumped up on the fence, from there to the clothes pole, and from that point to the shed outside our second story window where Mother was sewing; here he gained admittance. At table Reddy, with a napkin around his neck used to sit on the back of my chair; he insisted upon sharing my food, sometimes taking it from my mouth, as a squirrel takes nuts. After eating, I would say, "Wipe your beak Reddy," and he would wipe it on his napkin until it was quite clean. After that I would put him to sleep in my doll carriage. Often I took Reddy to the store on the back of my tricycle, and he would wait outside the door for me. Sometimes I placed two boxes one in front of the other, with a space between them, then I lined Reddy and the two hens on the farther one, and tapped upon the nearer; at this signal, the three flew across to me.

By and by some setting eggs were bought for Lady Smith; from these we raised seven little chicks; later we sold all but one and also Lady Smith and Lady Gandar. Then I just had Reddy and the baby chick which I named Queen Bess. One day the neighbors complained of Reddy's crowing and consequently we had to dispose of him by sending him to relatives in the country and now Queen Bess alone remains to me.

Queen Bess does all of the things that Reddy did and more. She says "No" by slowly shaking her head. Upon request she shakes hands with me. Last winter I put her on the front of my sleigh and slid down hill with her. Also, I put her in a little wagon to which my pet dog Ponce is harnessed and he gives her a ride. It is amusing to see Ponce licking off Queen Bess's beak after she has eaten something sweet. Queen Bess loves to be petted and makes dear little soft sounds in appreciation.

Out of the frosty north, like Indian arrows,
In never faltering flight the wild ducks flew,
And from the windy fields the summer sparrows
Reluctantly their feathery tribes withdrew.

From "October", James Newton Mathews.

Photo by J. H. Comstock

Residence of Gilbert White at Selbourne

Notes on Bird Migration by White of Selbourne, 1720–1793

Clara I. Thomas
Washington, D. C.

Of the almost innumerable subjects upon which Gilbert White made observations, his interest seemed to incline more to the study of birds than all others, and this is most natural when we consider that Selbourne must have been a veritable bird haven, for he says, "Selbourne parish alone can and has exhibited at times more than half the birds that are ever seen in all Sweden; the former has produced more than 120 species, the latter only 221. Let me add also that it has shown near half the species that were ever known in G. Britain." But that part of bird study which fascinated him most, probably because it is human nature to strive for that which eludes our reach, was the matter bird migration. There are but few letters in which he has not made some observation or comment upon this subject, often quite irrelevantly, so that one is impressed that that perplexing subject was constantly upon his mind.

In this advanced age when there are expert observers posted in all parts of our country recording the exact movements of birds

at all times, when communication is almost as swift as thought, it is not strange that we know the exact movements of every bird on almost every day in the year. But this is a subject which has been developed only in the last 25 years. In White's day, the old theories and superstitions were rampant and White stood almost alone as a believer in the definite migration of birds southward to other countries in winter. Again and again he was challenged by Pennant and to Barrington he wrote, "You are, I know. no great friend to migration; and the well attested accounts from various parts of the kingdom seem to justify you in your suspicions." But in that period naturalists were few, communication a serious business, with no telegraph, few newspapers, infrequent posts and unmentionable roads, so that facts to back up theories were next to impossible to obtain. White says, "It has been my misfortune never to have had any neighbors whose studies have led them towards the pursuit of natural knowledge; so that, for want of a companion to quicken my industry and sharpen my attention, I have made but slender progress in a kind of information to which I have been attached from my childhood."

To assist him in substantiating his theories, he used various means. His letters contain frequent appeals to his friends for observation of certain birds in other parts of England, especially when a journey was in prospect. In one letter he says, "I have no acquaintance at present among gentlemen of the navy; but have written to a friend who was a sea-chaplain in the late war desiring him to look into his minutes, with respect to birds that settled on their rigging during their voyage up or down the channel." He listened to the stories of his neighbors, for one sees often "An observing Devonshire gentleman tells me," etc. or, "Another intelligent person assures me ," etc. Though he heard many a tale about which there can be little doubt that the flight of the imagination was far more apparent than the flight of birds, yet he never ridiculed what others said or wrote, for he says, "Candour forbids me to say absolutely that any fact is false, because I have never been witness to such a fact."

Had White, with his wonderful perceptive power, been less content with the sedentary life of Selbourne, the advancement of knowledge in respect to bird migration would perhaps have taken more rapid strides in the 18th century for then assuredly would he have determined the wintering of many species in that distant

land of Andalusia, as Spain was then called. The thought of travel to foreign parts for himself, seems never to have occurred to him, however he says, "Some young man possessed of fortune, health and leisure, should make an autumnal voyage into that kingdom; and should spend a year there, investigating the natural history of that vast country. Mr. Willughby passed through that kingdom on such an errand; but he seems to have skirted along in a superficial manner and an ill humor, being much disgusted at the rude, dissolute manners of the people."

White's doubts of existing beliefs were the outcome of the accuracy of the records of his observations, and this shows how painstaking methods in very small matters, may often lead to the discovery of big truths. For instance, he kept a daily calendar about the birds he observed, so that, after several years, comparison showed him that some were migratory and others were not. He knew that some were summer residents, others only summer visitants, and some were only accidental. He knew the exact date on which all migratory birds would arrive in Selbourne in spring, and depart or pass through in the fall, and he makes frequent comment upon the punctuality of some or the unusually early or late arrival of others. Is it any wonder that he recognized in these facts, the key to the great migratory wave which sweeps over every land each year, and is it any wonder that much of his time was spent in trying to solve the mystery of where birds went, how they went and why they went?

His chief studies in bird migration were with the swallow kind and the ring-ousel and I shall attempt to make clear the beliefs of that time and White's discoveries to discredit these beliefs by his records of these two birds.

He says, "It is the hardest thing in the world to shake off superstitious prejudices: they are sucked in as it were with our mothers milk; and growing up with us at a time when they take the fastest hold and make the most lasting impressions, become so interwoven into our very constitutions, that the strongest good sense is required to disengage ourselves from them." That even a mind so used to reasoning and judging as his own should itself be a victim of superstitions proves how truly he spoke. People believed in the early days that as cold, inclement weather set in, the birds, like the bats, hid themselves in caves, earth banks or old buildings and passed the winter in a torpid state or like frogs ,burrowed into

the mud of river banks. White writes, "A Swedish naturalist is so much persuaded of that fact, that he talks in his calendar of Flora, as familiarly of the swallows going under water in the beginning of September, as he would of his poultry going to roost a little before sunset." In another letter he writes, "One of my neighbors, an intelligent and observing man, informs me that, in the beginning of May, and about ten minutes before eight o'clock in the evening he discovered a great cluster of house-swallows, thirty at least he supposes, perching on a willow that hung over the verge of James Knight's pond. His attention was first drawn by the twittering of these birds, which sat motionless in a row on the bough, with their heads all one way, and, by their weight, pressing down the twig so that it nearly touched the water. Repeated accounts of this sort, spring and fall, induce us greatly to suspect that house-swallows have some strong attachment to water, independent of the matter of food; and though they may not retire into that element, yet they may conceal themselves in the banks of pools or rivers during the uncomfortable months of winter."

In 1767 White put very little faith in these stories for he says, "As to swallows being found in a torpid state during the winter in in the Isle of Wight, or any part of this country, I never heard any such account worth attending to. But a clergyman, of an inquisitive turn, assures me that, when he was a great boy, some workmen, in pulling down the battlements of a church tower early in spring, found two or three swifts among the rubbish, which were, at first appearance, dead, but, on being carried toward the fire, revived. He told me that, out of his great care to preserve them, he put them in a paper bag, and hung them by the kitchen fires where they were suffocated." "Another intelligent person has informed me that, while he was a school boy, in Sussex, a great fragment of the chalk cliff fell down one stormy winter on the beach, and that many people found swallows among the rubbish; but, on my questioning him whether he saw any of those birds himself, to my no small disappointment, he answered me in the negative; but that others assured him they did." In 1769 he seemed quite convinced of migration. He says, "If ever I saw anything like actual migration, it was last Michaelmas day. I was travelling and out early in the morning, at first there was a vast fog; but, by the time that I was seven or eight miles from home towards the

coast, the sun broke out into a delicate warm day. We were then on a large heath, and I could discern, as the mist began to break away, great numbers of swallows clustering on the stunted shrubs and bushes, as if they had roosted there all night. As soon as the air became clear and pleasant they were all on the wing at once; and, by a placid and easy flight, proceeded on southward toward the sea." Yet in that same letter he writes, "I have frequently remarked that swallows are seen later at Oxford than elsewhere: is it owing to the vast massy buildings of that place, to the many waters around it, or to what else?"

How those swallows did perplex him! One of his notes reads, "I see by my Fauna of last year, that young broods come forth so late as September 18th. Are not these late hatchings more in favor of hiding than migration and, "About ten years ago I used to spend some weeks yearly at Sunbury which is one of those pleasant villages lying on the Thames, near Hampton Court. In the autumn, I could not help being much amused with those myriads of the swallow kind which assemble in those parts. But what struck me most was, that, from the time they began to congregate, forsaking the chimnies and houses, they roosted every night in the ozier-beds of the aits of that river. Now this resorting towards that element at that season of the year, seems to give some countenance to the northern opinion (strange as it is) of their retiring under water." After having observed some fledgling swallows as late as October 29th, he says, "Now is it likely that these poor little birds which perhaps had not been hatched but a few weeks, should at that late season of the year, and from so midland a country, attempt a voyage to Goree or Senegal, almost as far as the equator?" They had evidently been reported in Adamson's "Voyage to Senegal."

In 1774, he seems again to give credence to the old idea of hiding for he writes, "It is worth remarking that these birds are seen first about lakes and ponds; and it is also very particular, that if these early visitors happen to find frost and snow, as was the case of the two dreadful springs of '70 and '71, they immediately withdraw for a time. A circumstance this much more in favour of hiding than migration; since it is much more probable that a bird should retire to its hybernaculum just at hand, than return for a week or two only to warmer latitudes."

In 1777 he comes to a similar conclusion after observing that after the majority of house-martins had retired in October, he still saw a few stragglers in November. "From all these circumstances laid together, it is obvious that torpid insects, reptiles, and quadrupeds, are awakened from their profoundest slumbers by a little untimely warmth; and therefore that nothing so much promotes this death-like stupor as a defect of heat. And further, it is reasonable to suppose that two whole species, or at least many individuals of those two species of British hirundines, do never leave this island at all, but partake of the same benumbed state for we cannot suppose that, after a month's absence, house martins can return from southern regions to appear for one morning in November, or that house-swallows should leave the districts of Africa to enjoy, in March, the transient summer of a couple of days."

In 1781 he wrote again to Barrington telling how he had watched a belated flock of some 150 house-martins in October to discover the precise time of their retreat. He tells how they roosted for several evenings in a spot well-calculated for their winter residence; a spot clothed with beechen shrubs, stunted and bitten by sheep; besides it is the nature of underwood beech never to cast its leaf all winter; so that, with the leaves on the ground and those on the twigs, no shelter can be more complete. He concludes by saying, "I have only to add that were the bushes, which cover some acres, and are not my own property, to be grubbed and carefully examined, probably those late broods and perhaps the whole aggregate body of the house-martins of this district, might be found there, in different secret dormitories; and that, so far from withdrawing into warmer climes, it would appear that they never depart 300 yards from the village."

On one occasion White attempted to ferret out the hidden house-martins and he writes, "Supposing that the examination would be made to the best advantage in the spring, and observing that no martins had appeared by the 11th of April last; on that day I employed some men to explore the shrubs and cavities of the suspected spot. The persons took pains but without any success; however, a remarkable incident occurred in the midst of our pursuit—while the labourers were at work a house martin, the first that had been seen this year, came down the village in the sight of several people and went at once into a nest, where it stayed

for a short time, and then flew over the houses." This incident seems to me particularly humorous, for the martin observed was in all probability the first of its kind to arrive and that it should have done so on the very day that White had chosen to find their hiding place was indeed an amusing coincidence. He was absolutely sure, however, that bank swallows did not use their caverns in the banks for hibernation in the winter for he says, "The following circumstance should by no means be omitted—that these birds do not make use of their caverns by way of hybernacula, as might be expected; since banks so perforated have been dug out with care in the winter, when nothing was found but empty nests.'

As to the Ring-ousel, this was a bird newly discovered by White, about which he could find no records from any other observer. The bird was not a summer resident at Selbourne, like the swallows, but only a transient visitant. He did not know whether it was from England or northern Europe, but, evidently, was quite certain of its migration for he writes to Pennant, "Your approbation with regard to my new discovery of the migration of the ring-ousel, gives me satisfaction; and I find you concur with me in suspecting that they are foreign birds which visit us. What puzzles me most, is the very short stay they make with us; for in about three weeks they are all gone." Later he says, "Since the ring-ousels of your vast mountains do certainly not forsake them against winter, our suspicions that those which visit this neighborhood about Michaelmas are not Eng. birds, but driven from the northern parts of Europe by the frosts, are still more reasonable; and it will be worth your pains to endeavor to trace from whence they come, and to inquire why they make so very short a stay." That same autumn he states, "Those birds were most punctual again in their migration this autumn, appearing ,as before, about the 30th of September. If they came to spend the whole winter with us as some of their congeners do, and then left us, as they do, in the spring, I should not be so much struck with the occurrence, since it would be similar to that of the other winter birds of passage; but when I see them for a fortnight at Michaelmas, and again for about a week in the middle of April, I am seized with wonder, and long to be informed whence these travellers come, and whither they go, since they seem to use our hills merely as an inn or baiting place."

As to the little, soft-billed birds, he seems to have settled the question of migration beyond a doubt, for he says, "I was much pleased to see, among the collection of birds from Gibraltar, some of those short-winged Eng. summer birds of passage, concerning whose departure we have made so much inquiry. Now if these birds are found in Andalusia to migrate to and from Barbary, it may easily be supposed that those that come to us may migrate back to the continent, and spend their winters in some of the warmer parts of Europe. This is certain, that many soft-billed birds that come to Gibralter, appear there only in spring and autumn, seeming to advance in pairs towards the northward, for the sake of breeding during the summer months; and retiring in parties and broods towards the south at the decline of the year; so that the rock of Gibralter is the great rendezvous, and place of observation, from whence they take their departure each way towards Europe or Africa. It is therefore, no mean discovery, I think, to find that our small short winged summer birds of passage are to be seen spring and autumn on the very skirts of Europe; it is a presumptive proof of their emigrations." Though the swallow kind mystified him sorely, he came to this conclusion, "We must not deny migration in general; because migration certainly does subsist in some places as my brother in Andalusia has fully informed me. Of the motions of these birds he has ocular demonstration for many weeks together, both spring and fall: during which periods myriads of the swallow kind traverse the Straits from north to south, and from south to north according to the season."

As to the reasons for migration, he of course realized the influence of food and weather, but was also aware of other factors which he did not altogether understand. He says, "Now it is no wonder that birds residing in Africa should retreat before the sun as it advances, and retire to milder regions, and especially birds of prey, whose blood being heated with hot animal food, are more impatinet of a sultry climate; but then I cannot help wondering why kites and hawks, and such hardy birds as are known to defy all the severity of England, and even of Sweden and all northern Europe, should want to migrate from the south of Europe, and be dissatisfied with the winters of Andalusia." He accounts for the spring migration in a particularly quaint way. "The two great motives which regulate the proceedings of the brute creation are

love and hunger. As to love, that is out of the question at a time of the year when that soft passion is not indulged; besides, during the amorous season, such a jealousy prevails between the male birds that they can hardly bear to be together in the same hedge or field. Most of the singing and elations of spirits of that time seem to me to be the effect of rivalry and emulation; and it is to this spirit of jealousy that I chiefly attribute the equal dispersion of birds in the spring over the face of the country." The reason for the early retreat of the swift baffles him completely and he says, "This early retreat is mysterious and wonderful, since that time is often the sweetest season of the year. Are they regulated in their motions with us by a failure of food, or by a propensity to moulting, or by a disposition to rest after so rapid a life, or by what?" The reasons for migration became still more complicated when he considered the case of little birds. "We make great inquiries concerning the withdrawing of the swallow-kind," he says, "without examining enough into the causes why the summer short-winged birds of passage are never to be seen in the winter. The swallows are often found in a torpid state: but red-starts, white-throats, black-caps, etc., are very ill provided for long flights; have never been found once, as I ever heard of, in a torpid state."

Though it seemed incredible that birds, especially the little ones, crossed the Mediterranean and we have evidence that people believed that they rode across on the backs of big turtles, White reasons that they do not expose themselves to long oversea flights, saying, "It does not appear to me that much stress may be laid on the difficulty and hazard that birds must run in their migrations, by reason of vast oceans, cross winds, etc., because, if we reflect, a bird may travel from England to the equator without launching out and exposing itself to boundless seas, and that by crossing the water at Dover, and again at Gibraltar. And when arrived at Gibraltar, they scout and hurry along in little detached parties and sweeping low, just over the surface of the land and water, direct their course to the opposite continent at the narrowest passage they can find."

He gives an amusing explanation of the gregariousness of birds of various species in the fall migration, that are not used to living together at other times. "If I admire when I see how much congenerous birds love to congregate, I am the more struck when I see incongruous ones in such strict amity. If we do not much

wonder to see a flock of rooks usually attended by a train of daws, yet it is strange that the former should so frequently have a flight of starlings for their satellites. Is it because rooks have a more discerning scent than their attendants, and can lead them to spots more productive of food? Anatomists say that rooks, by reason of two large nerves which run down between the eyes into the upper mandible, have a more delicate feeling in their beaks than other round-billed birds. Perhaps then their associates attend them on the motive of interest, as lions are said to do on the yelping of jackals."

Gilbert White never tired of his investigations. He says: "Though I have travelled the Sussex-downs upwards of 30 years, yet I still investigate that chain of majestic mountains with fresh admiration year by year. Yet in great modesty he states, "My remarks are the result of many years' observation; and are, I trust, true on the whole: though I do not pretend to say that they are perfectly void of mistake, or that a more nice observer might not make many additions, since subjects of this kind are inexhaustible."

U. S. Has 7,000,000 Hunters

Returns From State Licenses Amount to $4,500,000

There are 7,000,000 hunters in the United States, according to the Chief Game Warden in the Biological Survey of the United States Department of Agriculture. This estimate was made from reports issued by the various States.

In 1919, 3,600,000 State licenses were issued, and in addition it is estimated that 3,500,000 hunters are exempted under various State provisions. The returns to the States from licenses was approximately $3,500,000, all of which was expended by the States in administration of State laws in the protection of game. This sum permits the employment of approximately 2,000 salaried State Game Wardens and 600 fee wardens. The Congressional appropriation for Federal game warden service for protection of migratory birds is $142,500, which permits the employment of only twenty-nine wardens.

At its recent meeting in Ottawa, the International Association of Fish, Game and Conservation Commissioners adopted a resolution calling for the issuance of Federal licenses for hunting migratory birds. The recommendation called for licenses in the form of special stamps to be issued by postmasters and attached to State licenses. It was estimated that the revenue from such licenses would amount to between $1,000,000 and $2,000,000, which could be used for the protection of game.

Unrest and Rest

LEON AUGUSTUS HAUSMAN

UNREST

Over the mill-wheel rushes the river,
Forever pouring,
Incessantly roaring,
Unrestfully leaping,
Tempestuously sweeping,
On to the sea it hurries forever!

Within the broad ocean
'Twould cease from its motion;
But lo, the great Sun
Wills it shall not be done
With leaping and turning
The huge mill-stones burning.
'Tis lifted on high,
And as clouds in the sky,
Goes fore'er floating by,
Back to the source of its primeval yearning.

It descends in the rain
And collects once again
In a thousand bright rills
From a thousand green hills,
And headlong continues its rush to the main!

O, unhappy river,
Unrestful forever,
Compelled thus to flow,
Unceasing to go
From hill, rill, and mill;
Wilt thou never be still?
When shalt thou be spent;
When rest in content;
Will the Sun ne'er relent,
O Sisyphean river?

REST

From hill to sea my merry course I take,
And as through flowery meads I bubbling flow,
My ripples 'neath their banks a happy choral wake
Or 'mid the sedges murmur soft and low.

With port sedate, through many a verdant plain
In stately wise and slow I tranquil glide;
Until at length, my journey o'er, I gain
A rest eternal in the oceans' tide.

Notes on the Structure and Habits of the Bird

Jay Traver
Supervisor of Nature Study, Wilmington, Del.

The first known bird is the Archaeopteryx. It had teeth and the column of vertebrae extended nearly the whole length of the tail; moreover it had three fingers on the "elbow" of each wing. This bird was probably the size of a crow, fluttered rather than flew about and probably walked on all fours quite frequently. It occurred during the Jurassic Period, and is the great connecting link which proves to us beyond doubt that our birds were descended from a reptile-like ancestor, doubtless very different from any reptile now in existence.

Other ancestors of the bird were the Ichthyornis and the Hesperornis. The latter was a typical water bird, rather like a loon in its habits—an admirable diver. To this end it had a long neck and long slender jaws with recurved teeth, the lower jaw being united in front only by cartilege, as in serpents. Probably it was capable of swallowing almost anything. The Ichthyornis had biconcave vertebrae, and teeth set in separate sockets. The Hesperornis compared somewhat with the penguins of our own era in that both were highly specialized for aquatic life. The Hesperornis swam by strokes of its great lobed toes, its wings dangling helplessly, till finally only a vestige of the humerus remained. Great speed was attained in the water by means of the large leg and toe bones. Unlike our penguin in another respect, it probably could not stand erect on land. This ancient bird had a brain comparatively smaller than that of any existing bird, and was unable to exist in a changed environment.

Other interesting birds, now extinct, of more recent periods are the *moas*, the elephant birds and the *phororhacos*. The latter had a head like an eagle, probably was 7 to 12 feet high and ran down its prey as a chicken does a grasshopper. These were found in South America and the South American *serienca* is probably indirectly descended from them. This bird shares the characters of cranes, bustards and eagles and runs down its prey, chiefly mice. The moas and elephant birds were probably not unrelated to the ostrich, and may very likely have been in existence almost up to the time of the coming of the white man.

Why have these birds become extinct? Because, as in the case of the Hesperonis, they were unable to adapt themselves to changing environment. Chapman says: "The measure of a bird's success in life is determined not alone by its powers as a migrant (if it be migratory); its attractiveness when wooing a mate; its skill as a nest-builder; its devotion and courage as a parent; the nature of its physical and mental endowment, or the degree of its intelligence, but also by the extent of its adaptability and the character of its temperament." That many birds have succeeded in life is proved today, when we see that they have conquered the dangers of a million years and have gained the foremost rank in the scale of living creatures.

The first thing to consider in our attempt to understand how it is that birds have succeeded so well, is the general framework of the body. One very interesting variation from our own bodies is seen in the vertebrae. In birds there are saddles on the vertebrae, a fact characteristic of birds alone. Sparrows have fourteen neck vertebrae, swans have twenty-three. In all birds but the Screamer there is a small bony projection from near the center of the upper part of each rib, a feature found elsewhere only in crocodile-like reptiles. The sternum is one of the largest bones in the bird's body. Its posterior edge is of many shapes and so is of value in classification. The size of the keel of the sternum is the criterion of the flying powers of the bird. A bird that trusts to the wind and soars considerably has a relatively small keel. In the humming bird, it is said that the muscular energy is greater and the bones more powerful than in any other animal and the keel of the sternum is relatively of great size. Birds are able to move their wings strongly and rapidly by means of well-adapted coracoid bones. In the bird's wrist there are but two free bones, and the femur is relatively small, the extra length being attained in the elongation of the next two lower joints. The knees of the bird are generally concealed beneath the skin. In the bird embryo there are several small bones in the tarsus of the leg. The skull of birds and reptiles hinges on but one bony projection, while in other mammals there are two such projections—another proof of the kinship of reptiles and birds. Moreover, in the embryonic bird the skull is cartilaginous as it always remains in the shark; also in the embryo there are four gill arches, one of which later entirely disappears. Nine air-sacs are distribured through the bird's

body, and in many birds the small bones are hollow, supplied with air from the sacs. The lungs are not elastic, but are flattened against the backbone and ribs. The temperature of the body is regulated by the quantity of air exhaled with each breath. Feathers, which are characteristics of birds alone, are planned entirely for lightness and strength. Each feather is composite, consisting of two rows of barbules on each barb and barbicels on the barbules. The air cannot force its way through such a structure. Flight is made possible by the accumulated resistance offered to the air. Each feather is exactly fitted, in size, structure, shape and coloring, for the part of the body in which it is found. These feathers are renewed by the process of moulting.

The extent to which the different senses are developed in the bird is another interesting point. The nostrils of the bird are encased in bone, with no exposed moist surface. As we would expect, the sense of smell is relatively unimportant in the life of the bird. Sight is most highly developed, in fact brought to such a high degree of perfection that it is difficult for us, from the consideration of our relatively poor eye sight, to comprehend it. The eyes of any creature indicate the relative powers of its intelligence, and the eyes of the bird are notably alert. There are three functioning lids to the birds eye, and in nearly all birds the movement of the lids is not the same as in human beings. The way in which the eyes can adjust themselves from long to short focus in an extremely short time is almost miraculous. Another well developed sense is that of hearing. One very strong argument for the birds keen sense of hearing is, that birds would not be capable of such wonderfully varied notes were their hearing not equally acute. Taste is very poorly developed, but never entirely lacking, while feeling is most active in the tip of the tongue and the beak.

We now come to more specialized characteristics of birds, as regarded from the stand point of their feeding habits. Fish-eating birds will be first considered. We find at once that adjustment to feeding habits has produced marked results. Many of the fish-eaters fly above the water, some near its surface, some further up. The skimmers have a prolonged lower mandible by means of which they can scoop up their prey from the surface of the water. Other birds, like the terns and snake-birds, have sharp spear-like bills, with which they are able to impale their prey. The pelican simply swallows fish and water indiscriminately into its pouch, discards the

water, tosses the fish into the air and catches it as it falls. Some water feeding birds, notably the flamingoes and herons, have very long legs adapted for wading and such birds have a proportionately long neck. In the flamingo, the mandible is bent downward to form an efficient feeding instrument. Other fish eaters dive for their prey, like the kingfisher, whose powerful beak and swift flight few fish can escape; or the penguin, which pursues the fish through its own element, and with great effectiveness. Still another type of beak is provided for the oyster-catcher, that interesting bird for whom a mollusc closed tightly over his bill has no trerors. The ducks are interesting water feeders, some being adapted to fish food, as the mergansers, others preferring a strictly vegetable diet. The mergansers have long, narrow bills with tooth like projections, while ducks have the typical duck like bill, with a sort of sieve arrangement for straining food from the mud. Correlated with structure of beak is structure of the whole body, but especially the feet. A swimmer must needs have apparatus to propel him through the waters, a wader long legs to keep him from sinking too deeply into the mud.

The insect-eating birds form a very large ,varied and extremely interesting group. Some birds are fitted for probing in damp muck for their food. A very good example of this type is the woodcock, the upper mandible of whose bill is capable of moving out from the lower one for some distance, to seek for insect larvae in the mud, and sensitive, to feel those larvae when located. The woodcock's eyes have also become adapted to the method of feeding, being now almost on the top of the head. Swallows, swifts, night hawks and some others fly circling through the air with gaping mouths to receive all unwary insects. Flycatchers prefer to let the insects come to them, so their feet are adapted for perching, their wings less strong for continued flight. Some insect eaters seek their food on the surface of the ground, turning over leaves and rubbish with beak or feet, or pulling the insects from their homes in the earth. A very important type of insect eaters seek their food on the trunks and branches of trees. Here belong the nuthatches, creepers, woodpeckers, and some others. The creepers and woodpeckers are especially adapted for such a life by modifications of tail as a prop, feet to cling to the bark, and bill to search out the insect prey. The woodpecker's bill is a drill, his tongue the ever-capable sucker for hidden meals.

Seed-eaters are another important group. Their feet are fitted usually for walking and perching, their bills conical for cracking seeds of many sorts. The crossbill's beak is further modified for picking out the seeds of pine-cones.

Flesh eating birds serve a great function as scavengers, and while not as beautiful nor as pleasing to our senses as most of the others, have an important function to fulfill. Nevertheless many are not scavengers, but pursue living prey. The feet of birds of prey are terrible grasping talons from whose iron clutch nothing can escape; their beaks, terrible instruments for rending and tearing flesh. In the true scavengers, the talons are not needed, nor are the birds able to lift any appreciable weight in their claws. While we do not like to think of the cruelty of the birds of prey, they perform for man a never-estimated service in killing rodents which would otherwise become uncontrollable pests.

Since we have briefly considered the adaptations of bodily form for seeking a livelihood in the world, let us see how much intelligence a bird has to aid it in the struggle for existence. The cerebrum is larger than that of a reptile. The brain is smooth, with no convolutions. By some, this is taken to mean lack of intelligence; but compare the intelligence of a bird with that of a walrus, which has a convoluted brain, and see if there is any question in your mind as to which is best able to adapt itself to changing environment. From various investigations and experiments, it seems that birds do not possess a reasoning power, as psychologists would define such a term, but they do exhibit a truly surprising power of memory implying association of experiences,—while in their hearing, sight and probable sense of direction, they are incomparably our superiors. "In my judgment," says Chapman it is to the keenness of these powers rather than any alleged gift of reason that the bird owes its success in life."

THE NATURE-STUDY REVIEW

DEVOTED PRIMARILY TO ALL SCIENTIFIC STUDIES OF NATURE IN ELEMENTARY SCHOOLS

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Editorial

What we Owe the Sportsman

It has become a habit with most nature lovers to seek to thwart the hunter and cast stones at him on all possible occasions; and undoubtedly there is much to be said against the gun in the hands of irresponsible people, especially of boys dominated by the savage instinct to kill whatever they see. But we should always bear in mind that the game laws were passed through the efforts of the sportsmen and that it is chiefly through their influence that game wardens do their work effectively.

First of all in early times, the hunter had as much right to hunt his prey as the owl had to hunt for mice or the phoebe to catch a fly, for he hunted in order to provide food for himself and family. This was true everywhere in America outside of cities a century ago. As civilization progressed, the hunter's table was provided with meat of domesticated animals and the necessity for hunting disappeared; but the passion for hunting still stirred strongly in the human breast and the result was hunting for pleasure, and hunting creatures partly to satisfy the savage hunting instinct and partly to give man a chance to show his prowess as a marksman and because a day's hunting or fishing took the hunter over hill and dale and gave him a wonderful experience in nature's realm, even though he may scarcely have realized it. Then trouble began,—the creatures hunted did not have the natural protection of the primeval forests but simply wood lots, here and there among cultivated fields. The streams were polluted or the forests cut away from their sources and they dried up so the fish disappeared. In childhood we knew of a trout brook in which the trout were plentiful which now "runs dry" during all the summer months. So game of all kinds became scarce and many species disappeared entirely and all were threatened with extinction.

Then the sportsmen began to realize the havoc they had wrought and made laws to protect all game during the breeding season and established refuges and preserves where the harassed wild creatures could live their lives for most months of the year unmolested. These laws have had far reaching effects. It is undoubtedly due to the fact that people became accustomed to abide by these laws, that we were able to pass and enforce other laws for protecting our song birds and many other forms of life that have no relation to game. The game laws educated the people up to the standard of supporting laws that were more far reaching in protecting a wider range of life, and this is our great debt to sportsmen.

Another debt we owe is a lesson in observance of law—a lesson not inculcated in our youth or our citizens as much as is best for our nation. The sportsman made the laws and his first claim to good sportsmanship is to obey them and insist upon obedience from others—this is what distinguishes him from a pot hunter. No one can look over a compendium of game laws of the United States without paying tribute to the energy and efficiency of the hunters who have proven themselves good sportsmen inasmuch as they are willing "to live and let live".

Nominations

The following nominations for officers to be elected at the annual meeting have been sent in:

For President, J. Andrew Drushel; Vice-Presidents, G. H. Trafton, Minn.; M. R. Van Cleave, Ohio; W. G. Vinal, R. I.; S. C. Schmucker, Pa.; Theodosia Hadley, Mich. For Directors to serve for three years, H. Honore Conover, Mich.; E. L. Palmer, N. Y.; Wm. T. Heilman, Ohio; A. F. Satterthwait, Mo.

News Notes

News Editor Cora A. Smith
817 Poplar St., Erie, Penn.

Very pleasing reports reach us concerning the success attending Professor Wm. P. Alexander in his new work of instructing and conducting field classes in connection with the Buffalo Society of Natural Sciences. Professor Alexander was formerly instructor in Cornell University in Bee-keeping and in Farm Nature-Study and has frequently contributed articles and poems to the Review.

The Hawaii Educational Review is a most interesting and enterprising publication. Professor Vaughan McCaughey, Superintendent of Public Instruction is the editor-in-chief and is helped by a staff of active associate editors. The magazine is devoted wholeheartedly to the task of helping and improving the schools of Hawaii which seem to be very advanced and successful, judging by their curriculum.

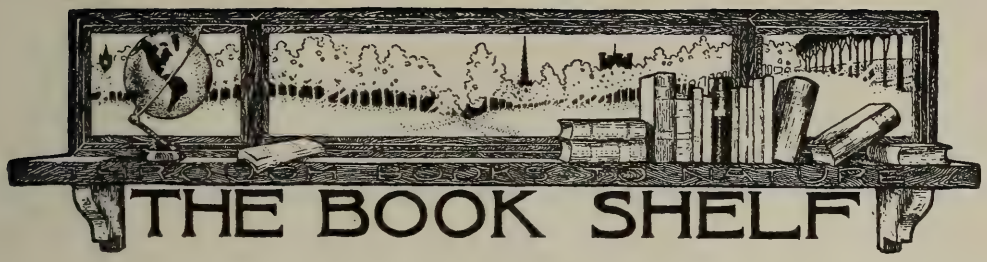
The Hawaii Educational Review has this pointed motto across its cover: *Every legislator entitled to the honorable title of statesman includes in his plans for legislation the highest practical education of the people.*

The Fur-Bearing Animals of the U. S. and the Laws for 1920 relating to them is the subject of *Farmers Bulletin, No. 1165* of the U. S. Dept. of Agriculture, Washington, D. C. This is a very important bulletin and should be in every school library in the land.

The Recruit Educational Center at Camp Upton, N. Y., has issued a series of booklets for teaching illiterate and foreigners in the army how to read and write and incidentally teach much of history and patriotism. The booklets are enlivened with some clever cartoons illustrating the doughboy's difficulties in learning the English language.

"Teach if Cornered; Otherwise Let the Children Learn" is the title of an article on teaching music in *The California Blue Bulletin* of recent issue. This motto should be the slogan of the nature-study teachers everywhere. This Bulletin is always filled with many practical helps for the teachers of California and it is a pity that it's circulation should not be more extended in the East.

The Cornell Rural School Leaflet for November, written by Dr. E. Laurence Palmer, deals with aquatic insects and completes in a most interesting manner the work suggested in the March leaflet on the fishes and plants of the streams and ponds. The insects and other creatures living in still waters are dealt with separately from those living in moving waters. These little water dwellers are figured in outline so that each may be readily recognized by the child as he finds it in the water, each figure is numbered and on the very practical and interesting life history chart following the pictures these numbers refer to the name and habits as far as known of each species. In addition are notes on fifty things to be seen in November in the fields and woods with suggestions as to where they may be found.



In Berkshire Fields by Walter Prichard Eaton with eighty illustrations by Walter King Stone, 312 pp., Price $3.50. Harper & Brothers.

This is a nature-study book *de luxe* and is from every point of view genuine nature-study. Mr. Eaton has open eyes and an understanding spirit for the plants, animals, birds and their environment in his beloved Berkshires; it is the sympathy of his mental and spiritual attitude that gives his writings a living quality and peculiar charm. Take this description: "There is nothing, to me, more fraught with charm and delightful associations than a New England upland pasture, a pasture of irregular outline, with capes of fir and birch jutting into it from the surrounding forest, with a mountain going up above and a long green valley dropping away below, perhaps to the distant white spire of the village church, with patches here and there of raspberry and blueberry and huckleberry bushes, and cow-paths amid the fragrant sweet-fern, with thistle tops and steeple-bush to prick the field with pink, with the tinkle of a distant cow-bell—and, as the sun is sinking in the west the fairy flutes of the white-throated sparrows. It is on the edges of such pastures that the white-throats (or Peabody birds) build their nests from the Adirondack and White Mountains northward." Mr. Eaton has by no means confined himself to the things he sees in the Berkshires but has a delightful way of harking back to some experience of his boyhood or some later observation: "The white-throats build their nests frequently on the ground, but sometimes in low bushes or fallen, dead trees. I have found them in the dry branches of a small prostrate fir. And I have sat beneath a tree on the edge of a pasture on Cannon Mountain in Franconia and listened for an hour while a parent bird tried to teach a baby to sing. I have been told by real ornithologists that I did nothing of the kind, to be sure, but that constrains me to think the scientists do not know everything. The parent bird would sing, once, perfectly, and then, in a feebler tone, the baby (both birds plainly visible not twenty feet over my head) would attempt the same thing. Sometimes he would jump the fifth correctly, sometimes he wouldn't come within two notes of it; and not once, in the entire hour, did he get the succeeding intervals with accuracy. But the parent bird, fluttering from twig to twig about him, kept opening her white throat and pealing out the perfect song, and the little bird kept trying to copy it. I suppose she wasn't really teaching it, because she had no blackboard nor piano "

The illustrations by Mr. Stone are exquisitely adapted to the text. They are full of life and true feeling. Well may the volume be dedicated to William Hamilton Gibson, for not since his inspired brush gave us back in pictures the scenes that we love, has there been anything produced so nearly of the same quality as these illustrations. The well chosen and charmingly delineated landscapes make perfect back-grounds for chickadee, hare, woodchuck, porcu-

pine, meadow mice, fox, otter or weasel or of many another little brother of the field and wood and his delineation of trees is quite as perfect. There is in every picture fidelity to nature and fidelity to art; each one invites to study and happiness.

In Berkshire Fields is the kind of book that one wishes to keep always at hand, so that during any spare moment a page may be read and a picture contemplated. If we are not privileged to wander through the beautiful Berkshires on our own feet, we can make refreshing daily excursions with these two nature lovers who have so happily combined their art in one volume.

Trees, Stars and Birds—Edwin Lincoln Moseley, A.M., Head of Science Dept. State Normal College of Northwestern Ohio—404 pp. illustrated. World Book Co.

This belongs to the New World Science Series edited by John W. Ritchie, published by the World Book Co. This is essentially a Nature Study book and a helpful one and is written for pupils of sixth or seventh grades but is quite as interesting to older people. It is planned for a year's work. The trees in the fall, the stars in the winter and the birds in the spring. The work on trees begins with a chapter on Becoming Acquainted with Trees which includes methods of making a herbarium of trees, leaves, twigs, fruits and woods. Then comes a clear chapter on the structure of a tree and then follows interesting accounts of the different kinds of trees with chapters at the end on Transplanting and the Care of Trees and an appendix containing a key for identifying the hard woods.

The part on Stars is particularly well arranged and developed, and up-to-date and in our opinion is one of the most valuable parts of the book. We very much approve of this being a part of the year's work for sixth and seventh grades. It has always seemed such a pity that the ignorance of the stars is so widespread and dense, a condition that this book is well calculated to alleviate.

The part on Birds is especially valuable in discussing the bird families, their characteristics, habits and relationship, giving a coherent outlook over the bird world. Interspersed are chapters on Classification of Birds, Feeding Birds in Winter, Migration of Birds, Making Grounds Attractive to Birds, with an Appendix on dimensions of nesting birds. After each part is a list of reference books that is well chosen.

The book is well illustrated in every part and the colored pictures of 58 common birds by Fuertes obtained from the Bureau of the Biological Survey of the U. S. Dept. of Agriculture brings these beautiful and most useful pictures within the reach of all pupils, a most desirable thing in itself for it has seemed a hardship that these pictures should be allowed to go out of print.

American Boys' Handy Book of Camp-Lore and Woodcraft, by Dan Beard, 270 pp. with 377 illustrations by the author, J. B. Lippincott & Co., $3.00.

Dan Beard has spent his years and energies making life interesting to boys and this volume is a good climax to this most valuable work. No one can open its pages without longing to be a boy and go camping and do everything so fascinatingly described and pictured. The following are the chapter headings:

Fire Making by Friction, Fire Making by Percussion, How to Build a Fire, How to Lay a Good Cooking Fire, Camp Kitchens, Camp Food, Packing Horses, The Use of Dogs, Man Packing, Preparing for Camping Trip, Saddles, Choosing a Camp Site, Axe and Saw, Council Grounds and Fires, Ritual of the Council Fire.

However, these interesting topics for chapters convey but a small idea of the interesting things they cover. The chapter on Packing Horses beguiles us—How to make a pack horse of your own, How to make an aparejo, How to make a China, How to make a latigo, How to throw a diamond hitch, How to throw a squaw hitch, How to hitch a horse in open land without post, tree or stick or stone, Use of hobbles and how to make them, How the travois is made and used, Buffalo Bill and General Miles, How to throw down a saddle, How to throw a saddle on a horse, How to mount a horse, How to know a western horse. The pictures are still more beguiling—a barrel made into an expedient steed upon which packs can be laid and cinched with impunity until the learner is sure enough of his method to try it on a "sure enough" horse. Each one of the 377 illustrations by the author tells how something should be done. In fact the pages printed or pictured are packed full of information for the boy, information that is dynamic because it makes the boy want to start instantly to transmute the book into experience.

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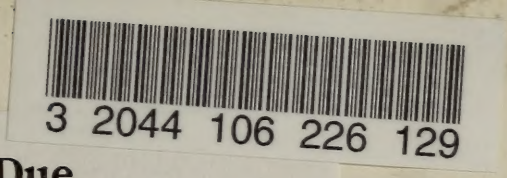
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